NATIONAL ASSOCIATION
FOR THE STUDY AND PREVENTION
OF TUBERCULOSIS

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National Association for the Study and Prevention of Tuberculosis

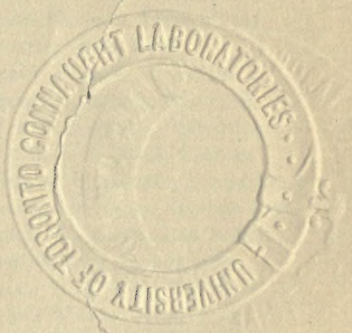
TRANSACTIONS

OF THE

SECOND ANNUAL MEETING

WASHINGTON, D. C.

May 16th to 18th, 1906



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SECOND ANNUAL MEETING

OF THE

National Association for the Study and Prevention of Tuberculosis

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The second annual meeting of the National Association for the Study and Prevention of Tuberculosis was held at the new Willard Hotel, Washington, D. C., Wednesday, Thursday and Friday, May 16, 17 and 18, 1906.

In preparing the program the Executive Committee had provided for two new sections, a Surgical and one of Tuberculosis in Children, in addition to the three previously existing. Each of the older sections held two sessions and the newly formed one each.

In the absence of Dr. Hermann M. Biggs, the President of the Association, Dr. Lawrence F. Flick, Vice-President, occupied the chair. The opening meeting on the evening of May 16 was a joint session of the National Association with the Association of American Physicians, at which the President of the latter society, Dr. Frank Billings, presided, the address on that occasion being by Dr. Simon Flexner, of New York.

At the business meeting of the Association, held on the evening of May 17, following the vice-presidential address of Dr. Flick, the six directors whose terms of office expired by limitation were re-elected, namely, Drs. H. M. Bracken, Minnesota; W. S. Carter, Texas; Henry Barton Jacobs, Maryland; E. O. Otis, Massachusetts; Edward L. Trudeau, New York, and William H. Welch, Maryland.

By the amendment to the By-Laws providing for the enlargement of the Board of Directors to sixty, the following new directors were nominated by the Board and elected by the Association:

Redfield Proctor, Jr., Vermont; W. T. Sedgwick, Massachusetts; Rowland G. Hazard, Rhode Island; Homer Folks, New York; Dr. Walter B. James, New York; Dr. Edward G. Janeway, New York; Dr. Alfred Meyer, New York; John Seely Ward, Jr., New York;

Charles M. Lea, Pennsylvania; Dr. Joseph Walsh, Pennsylvania; Otis H. Childs, Pennsylvania; Dr. John J. Black, Delaware; Robert Garrett, Maryland; William H. Baldwin, District of Columbia; Samuel Gompers, District of Columbia; Dr. George M. Kober, District of Columbia; Dr. C. F. McGahan, South Carolina; Dr. T. D. Coleman, Georgia; Dr. John H. Lowman, Ohio; Charles W. Fairbanks, Indiana; Dr. Frank Billings, Illinois; A. A. Sprague, 2d, Illinois; David R. Francis, Missouri; C. E. Perkins, Iowa; James J. Hill, Minnesota; Dr. Sherman G. Bonney, Colorado; Dr. Henry Sewall, Colorado; Dr. W. H. Flint, California, and Benjamin I. Wheeler, California.

The following resolutions, having been endorsed by the Committee on Resolutions, were unanimously adopted:

Introduced by Board of Directors:

RESOLVED: That the National Association for the Study and Prevention of Tuberculosis adopt the double red cross as the official emblem of the association.

Introduced by Dr. W. W. Keen through the Surgical Section:

RESOLVED: That in the interests of clearness and uniformity of nomenclature the Association employ in its official publications the term *tuberculous* to refer to lesions or conditions caused by the tubercle bacillus and the term *tubercular* to describe conditions resembling tubercles but not caused by the tubercle bacillus.

Introduced by Dr. J. W. Brannan through the Section of Tuberculosis in Children:

WHEREAS, Recent experience in Europe and in this country has shown that outdoor life in pure air has the same curative effect in surgical tuberculosis as in tuberculosis of the lungs, therefore, be it

RESOLVED, That in the opinion of the members of this Association hospitals and sanatoria should be established outside of cities either in the country or on the seashore, for the treatment, from its incipiency, of tuberculosis of bones, joints and glands in children.

At a meeting of the Board of Directors held on Friday, May 18th, the following officers were elected for the ensuing year: Dr. Hermann M. Biggs, President; Dr. Lawrence F. Flick and Dr. Vincent Y. Bowditch, Vice-Presidents; Dr. Henry Barton Jacobs, Secretary; Gen. George M. Sternberg, Treasurer.

The following directors were elected to serve on the Executive Committee for the ensuing year: Mr. W. H. Baldwin, Dr. Vincent Y. Bowditch, Dr. Lawrence F. Flick, Mr. Homer Folks, Dr. J. P. C. Foster, Dr. E. C. Janeway, Dr. Arnold C. Klebs.

Dr. Edward L. Trudeau was elected an Honorary Member of the Association.

MEETING OF THE ADVISORY COUNCIL

THE first meeting of the Advisory Council for purposes of organization was held on Wednesday evening, May 17th. Vice-President Flick called the meeting to order and requested Mr. W. H. Baldwin, of Washington, to act as temporary Chairman.

The Executive Secretary then read the amendment to the By-Laws, providing for the Advisory Council, and stated the objects of its organization. He also read a list of the various associations that had appointed representatives to the Council in response to the invitation of the Board of Directors. It was found upon roll call that there were sixteen organizations represented.

On motion of Dr. Norman Bridge, Mr. William H. Baldwin, of Washington, was elected permanent Chairman of the Advisory Council and Dr. Livingston Farrand, Secretary. After discussion as to methods of organization, it was voted that a committee of five, in addition to the chairman and secretary, ex-officio, be appointed by the chair to draw up a plan of action and program for the next meeting, with power to confer with the Executive Committee of the National Association and take such action as might be approved. The chair appointed as members of this committee: Mr. Homer Folks, New York, chairman; Dr. John H. Lowman, Cleveland; Dr. Norman Bridge, Los Angeles; Dr. Dunning S. Wilson, Louisville; and Mr. Alfred Muller, Denver.

ADDRESS OF THE VICE-PRESIDENT

The Duties, Responsibilities and Opportunities of the National Association for the Study and Prevention of Tuberculosis

By Lawrence F. Flick, M.D.

Philadelphia

Great movements have humble beginnings. At first a few thinkers work out an abstruse problem and catch enthusiasm from innate optimism and dim prospects ahead. They labor in silence, shedding light upon a little coterie of men and women around them. The truth dawns upon practical men and women and organization results. Here and there a leader arises and attracts to himself those who see the light. Bye and bye small movements coalesce and form bigger movements. Later on larger movements join forces and form still larger movements until the world is united in a grand crusade. This has been the history of every struggle for the betterment of mankind.

Extermination of the great white plague is the world work of this generation. The thinker has been at work in the laboratory and at the bedside and has completed his task. He has demonstrated that tuberculosis can be stamped out. With enthusiasm he has taught the truth to the little coterie around him, conscious of what was to come and cognizant of the difficulties in the way. Pasteur forecast the harvest in his famous dictum: "It is in the power of man to cause all parasitic disease to disappear from the world." Koch foretold the difficulties to be encountered when he said: "That not until a younger generation had appeared would it be possible to bring about intelligent supervision of tuberculosis." Villemin, Erlich and many other noble workers in the field stood the heat of the day but like Moses were permitted only to look into the promised land.

Can the world ever appreciate the boon conferred upon it by the laboratory and bedside workers who have made the crusade against tuberculosis possible? These men have discovered the secret by which

the greatest enemy of mankind can be overcome and they have given it to the world free. "What will not a man give for his life?" They have come into possession of that which means life, happiness and comfort to millions; that for which man will give anything he possesses on earth, and they have presented it free to the world without compensation or return. They have not locked up their precious discovery for a ransom; they have not taken out a copyright or patentright in order to protect their interests; but they have given it freely to the world and have even used up their energy in trying to force it upon the world. Their liberality dooms tuberculosis to extinction. The truth which they have taught has leavened the mass and fermentation has set in. The new idea has taken hold in every part of the world and has everywhere started centers of activity for the extermination of tuberculosis. The crusade has indeed begun.

Two years ago the National Association for the Study and Prevention of Tuberculosis was organized to help along this crusade. At that time organized effort had already been made in many parts of the country and much had been accomplished in the way of preliminary education. Movements for controlling tuberculosis were springing up everywhere. It was evident that a central, controlling and directing influence was needed and our association came into existence in response to that necessity. The history of the movement during the two years is ample justification of our organization.

What was accomplished by our association during the first year in part is told by the Transactions of the first annual meeting, a copy of which has been placed in the hands of every member. This volume is a credit to us and speaks well for the future of the crusade against tuberculosis in our country. It presents in a concrete form the intelligent and well-directed activity of the men and women who are working in this crusade and lines up our forces to the edification and encouragement of all.

The volume shows only what was done during the first year, however, and gives no inkling of the developments since. Much progress has been made since. During the past year many local societies have been organized under the auspices of the association and preventive measures have been stimulated in many places through its indirect if not direct influence. The mere existence of the National Association for the Study and Prevention of Tuberculosis, carrying on its roll the most prominent workers in the cause throughout the country,

has had a beneficent effect upon local effort in every place in which such effort has been made. The stamp of authority has thus been given to the cause everywhere and small movements in towns and country districts have come into existence through the aid of public sentiment created by it.

Some of the most important things which have been done by our association during the past year are: (1) the invitation of the International Congress for the Study and Prevention of Tuberculosis to the United States for its next session in 1908; (2) the inauguration of tuberculosis exhibitions in large cities of the country; and (3) the creation of an advisory council of the association. All three of these actions are pregnant with much good for the cause and will help to put the crusade on a secure footing. So far only the initial steps have been taken in these matters and much remains to be done.

For bringing the next International Congress to this country the association is much indebted to President Roosevelt and Ambassador McCormick, both of whom gave the undertaking cordial endorsement and valuable assistance. The personal endorsement of our invitation by these gentlemen endowed it with a national significance and technically brought it within the perview of the congress, thus making it possible for us to carry off the coveted prize. Much aid was also given by our fellow-member, resident in Paris, Dr. A. J. Magnin. The invitation was cordially received by the congress and accepted with applause. Delegates from all over the world manifested pleasure at having the congress come here and unanimously expressed the intention of attending it. The universal feeling seemed to be that the logical place for the next congress was the United States, and that with the wealth, enterprise and resourcefulness of this country the next congress ought to be vastly the greatest and most successful that the world has seen.

Realizing the duties and responsibilities assumed by inviting the next congress here, and the great opportunity which the holding of this congress gives us for advancing the crusade against tuberculosis, our board of directors immediately took preliminary steps for the organization of the coming congress. A committee was appointed to raise a fund of one hundred thousand dollars for the expenses of the congress and to draft a general plan for its management. The plan has been presented to the board and has been adopted. It contemplates offering prizes to the whole world for the stimulation of

activity in the crusade against tuberculosis and for the best exhibit of work done during the three years intervening between the last congress and the coming congress. This will extend the influence of the congress over the three years and make the congress worthy of our country and the great cause for which it will be held.

Twenty-five thousand dollars has already been subscribed to the fund and has been deposited in bank. The subscribers are Mr. Henry Phipps and Mr. George Blumenthal of New York, Mr. Martin Maloney and Mr. William P. Henszey of Philadelphia, and an anonymous gentleman of Boston, each of whom has given five thousand dollars. The balance of the fund will be subscribed, we have reason to believe, in the near future and might have been in hand before now except for the fact that it is deemed good policy to have the subscriptions come from all parts of the country. Men who have been asked to contribute have responded with an enthusiasm which is most inspiring and an intelligent grasp of the whole subject which forbodes well for the undertaking. Twenty subscribers are to be secured and the twenty will constitute an honorable board of council of the congress. With this backing of broad-minded, patriotic, philanthropic business men the congress cannot fail of success in any sense of the word.

It would be well for the association, through its board of managers, at once to organize the committee on the congress and to open an office in Washington for the transaction of business of the congress. Foreign countries and individual states in this country ought to be invited to participate in the congress at as early a date as possible, so that they can appoint delegates and prepare exhibits. Much time is required for all these things, and unless ample time is given many countries will decline to participate. Besides, we need a good deal of time ourselves to create our own machinery for the congress. The committee ought to consist chiefly of men who have obtained subscribers to the fund, but others also should be placed upon it. Men in different parts of the country have been asked to get subscribers in order that the entire country may participate both in the contribution of the fund and the expenditure of the money. This will establish mutual confidence between the men who give the money and the men who spend it and no doubt will make for success.

All official business of the congress should be transacted in Washington in order to stamp our national character on everything we do; otherwise foreign governments and societies will misunderstand and

misconstrue our position and will fail to respond to our request for co-operation. We should work as far as possible in this matter under the auspices of our national government. The national government should be asked to participate as other governments are asked to participate, but it also should be asked in that participation to give us a national character by which we can take our place among the international congresses of the world. This could be accomplished through the government's exhibit without committing the government to anything more than the success of its own exhibit. In addition, the government might perhaps be willing to supply the quarters for the exhibit of the congress and the place for the congress to meet.

The exhibitions on tuberculosis which have been held during the past year under the auspices of our association and the local associations of different cities have had a wonderfully good effect in stimulating the crusade against tuberculosis. They have educated the public in a practical way by showing them what the crusade means and how it is to be accomplished. The exhibitions have been well attended wherever they have been held; have been well reported by the public press; and have led to much inquiry and discussion. They should be continued and even repeated in cities in which they have been held. It might be well indeed for the larger cities to get up permanent exhibitions and bureaus of information so that the public can at all times inform itself and keep abreast of what is going on.

The creation of the advisory council is undoubtedly a step in the right direction. This council will place the association in touch with boards of health, societies, hospitals, sanatoria and organizations of every kind which can in any way aid the crusade against tuberculosis. It will enable the association to direct and in some measure control the work which is going on in every part of the country and thus conserve energy and perhaps economize time and money. It will also enable the association to get advice and assistance from many workers in all parts of the country. This advisory council has not yet been completed but has been sufficiently developed to be put into operation at this meeting. It will be completed by the board of directors during the coming year.

What has been accomplished by our association thus far, although most gratifying, is a mere shadow of what remains to be done. We have launched into the greatest crusade which the world has known and our work still lies before us. We have undertaken to organize

the forces for stamping out a disease which carries off one-seventh of all human beings who are born; which afflicts and embarrasses the human race in every way; which is responsible for many human burdens and shortcomings; and which carries its devastation into every department of the animal kingdom. To destroy such a monster is no small undertaking and will tax all the resources of the human family even with our advanced civilization. Our strength, however, lies in the knowledge that the end can be accomplished. Let us convince the world that tuberculosis can be stamped out and people will flock to our aid with enthusiastic hearts and willing hands.

The measures by which tuberculosis is to be stamped out have been fully outlined and clearly defined. There must be hospital accommodations for all poor consumptives who cannot recover and who cannot be made harmless at home; there must be dispensaries for all walking cases of tuberculosis who are too poor to employ expert services and who cannot be treated in their homes without prejudice to others; there must be sanatoria for all poor consumptives who are still in the curable stage of the disease and who cannot be successfully treated in their homes; there must be convalescent farms for tuberculous subjects who have been restored to physical well being, but need hardening up under direction and supervision; there must be experts in the prevention and treatment of tuberculosis and these must be trained in our medical schools and in our post-graduate schools; there must be control of tuberculosis in domestic animals and prevention of intercommunication of tuberculosis between human beings and animals; there must be reconstruction of boards of health to bring them in line with modern ideas about the prevention of disease; there must be co-ordination of societies interested in philanthropic and sociological work in the interest of the poor and the laboring classes; and there must be a remodelling of laws and customs in harmony with the new ideas of preventive medicine. This is indeed a large program but it can be carried out.

How are we equipped to carry out this great program? It is worth while analyzing our membership roll for the purpose of taking stock of our resources and making our plans for work. So far over sixty-six per cent. of our members are physicians; five per cent. are women; two per cent. are professors of colleges and universities; one per cent. are clergymen; and the balance is scattered among all the various callings of life. This gives us a fair working basis, but the

composition of our membership is surprising, and indicates to us the lines along which we have to exert ourselves most. It also gives us a suggestion as to how to interest people. The function of the doctor, as usually interpreted, is to cure disease, and public opinion grants him remuneration only when he administers to the sick. No sickness no remuneration, is the popular verdict. May I digress to say that this is wrong, and that both the physician and the public should be educated to a proper appreciation of advice in prevention of disease. When the physician now engages in the extermination of disease he strikes at his own calling and literally snatches the bread and butter from his mouth and the mouths of those who are near and dear to him.

One may well ask why do physicians predominate in this crusade against tuberculosis? Why are other callings not represented more largely? How account for this strange phenomenon that men and women use up their energy in trying to destroy that which is a source of revenue to them, while others who would be benefited by such a course remain idle and indifferent. The explanation is simple enough. The physician who has gone into the crusade against tuberculosis has gone into it as a philanthropist and not as a physician. Knowledge of the secret that the great white plague can be stamped out impels him on and he follows his nobler impulse of working for the good of all instead of his selfish instinct of looking out for his own interests. Others have not come into the work because they do not know the truth. Knowledge is the stimulating force and knowledge should be the watchword of our crusade. The same knowledge which has spurred on the physician will arouse everyone else and will set the world aflame with a burning desire to stamp out tuberculosis.

Woman makes a good showing on the membership roll of our association but not as good as her philanthropic instinct warrants. Strange to say, many of our women members are also physicians. Knowledge here again is the inspiration. Woman should occupy a prominent position in the crusade against tuberculosis, as she instinctively recognizes a good cause and is drawn to it the moment she recognizes it. To prevent human suffering and to obviate disease with all that follows in its wake, is so in harmony with her nature that she needs but be given the opportunity for it and made to comprehend it to pursue it with avidity. Our membership of women does not correctly represent woman's activity in the crusade against tuberculosis, as her membership is not in proportion to the work which she has done. Much

of the good work which has been done in our large cities for the mitigation of the suffering of the consumptive poor has been done by women alone or in conjunction with men. Many more women will affiliate themselves with our association when they properly understand our aims and objects, and more fully realize what the crusade against tuberculosis means; and we should make it our business to bring the subject before every woman in the land.

Professors of colleges and universities have a fair representation of our roll, but not what one might expect. Teachers in such institutions are in close touch with the scientific world and ought to be informed on the preventability of tuberculosis. It may be that our association has not been brought to their attention. We should endeavor to place the name of every professor in the land upon our roll and to acquaint him with what can be done for the prevention of tuberculosis. No one has better facilities and opportunities for advancing the truth than teachers in our higher colleges and universities, and probably no one would be more ardent in advocacy of the cause than they, were the truth brought home to them.

Strange to say, professors of medical colleges are not taking a very prominent part in the crusade against tuberculosis. A fair number are members of our association, but they are not very active in our work, and rather a large percentage of those who are members are professors in the chairs of pathology and bacteriology. This perhaps is further evidence that physicians have not gone into the crusade against tuberculosis as physicians but rather in spite of the fact that they are physicians. The medical profession as a body has really retarded the crusade against tuberculosis rather than advanced it. Paradoxical as it may seem, here again knowledge plays a part. Medical men, above all others, should have knowledge of the preventability and curability of tuberculosis, but they are so handicapped with traditions that they are slow to accept new ideas. They hear the truth but are deaf to it. They cannot believe that what has been accepted as truth so long can be untruth. Even the teachers of medicine cling to the old ideas. The advanced teachings about tuberculosis have as yet penetrated the walls of very few medical colleges. This is much to be regretted. The teaching faculty of the medical profession could do much to advance the crusade against tuberculosis did it take up the matter in a proper spirit. Young men who graduate in medicine still go out unqualified to diagnose, treat or prevent the

disease. Every college should equip itself to teach all that can be taught about tuberculosis and to train its men in physical diagnosis. It should have wards for advanced cases, balconies or roof wards for early stage cases and dispensaries for walking cases. Its students should be given every facility for studying tuberculosis in all its forms and phases and for observing the application of practical measures for the prevention of the disease. Were all graduates of medicine turned out properly equipped to diagnose, treat and prevent tuberculosis, the crusade would be a short one. Perhaps our association can find a way of interesting medical colleges in this work.

A most disappointing feature of the crusade so far is the participation of the clergy in our work. Theoretically one would expect the clergy to be largely represented on our roll, as they are educated men, in touch with the seamy side of humanity, and have a full knowledge of what tuberculosis means to mankind. It must be that they are behindhand in knowledge about the preventability of tuberculosis. One cannot conceive that they realize what this crusade means and remain outside of the battle lines. No body of men has better vantage ground for work in this crusade than they. It may be our own fault that we have so few of them with us.

Every clergyman in the land should be brought into line and if necessary labored with individually until he understands the work. When he understands it he will participate. What clergymen can do is well illustrated by what one did of whom I have personal knowledge and of whose efforts I have had an opportunity to watch the outgrowth. Eleven years ago I was attending a clergyman in an attack of pneumonia, and during his convalescence explained to him the preventability of tuberculosis. He manifested deep interest in the matter and after his recovery called together some of his parishioners and organized them into a committee to look after the consumptive poor of his parish. This committee made arrangements with hospitals to accept consumptives in separate wards at five dollars a week and collected money to support the beds. The work grew rapidly and in a year extended beyond the parish. Within two years it became nonsectarian and spread over the whole state. The good which has come from this clergyman's initiative is simply marvellous. The society which sprung from this humble effort has now nearly a thousand members; it has established a large sanatorium of one hundred and seventy-two beds; it has maintained since its organization about three thousand patients;

out of its work has grown an institute for the study, treatment and prevention of tuberculosis; out of its work have sprung up a number of small sanatoria for the treatment of the consumptive poor; and indirectly out of its work have sprung up at least four private sanatoria for pay patients. All of this has come about because one clergyman was convinced that tuberculosis can be stamped out and threw his soul into the movement.

The laity has not as yet taken hold of the tuberculosis problem properly. Lawyers, judges, bankers, merchants, manufacturers and business men of every kind should be members of our organization, and would be if they understood our work. Money-making men are ever ready to help in a good cause if the cause appeals to them. They may not be able to give time and thought but they can and will give money. They must, however, have confidence and be interested.

How to interest business men in a work of this kind is a problem which requires careful thought. The exactions of business use up the energy and time of those engaged in it, leaving little for anything else, hence it is difficult to get the attention of business men. They cannot give enough thought to the crusade against tuberculosis to fully realize what it all means, and without thought they do not become interested. Perhaps the best way to reach them is to create a strong public sentiment in support of the crusade which will carry them along with it. The creation of such a sentiment is one of the tasks before us. Recent events teach us a lesson in this regard. The public as a body cannot grasp an abstract idea. Only that which comes in concrete form has any effect. When a great calamity befalls a people or any part of a people everybody is willing to give for its relief and give generously. The greater and the more sudden the catastrophe the more generous the public. Under these conditions sentiment, a public sentiment, if you like, sways the people and they give out of sympathy and not from reason. They act on impulse and in competition with each other.

The great calamities which have befallen parts of our country within the memory of those past middle life, namely, the Chicago fire, the Charleston earthquake, the Johnstown flood and the San Francisco earthquake and conflagration each brought the world to its feet with offerings of money and relief. Everybody gave and wealthy men gave most generously. Everybody gave on faith, moreover, without personal knowledge of the condition existing in those places or of the

manner in which the money would be expended. There was no time for thought of such things. Everybody agreed that help was needed and everybody was willing to help. The descriptions of the catastrophes in the newspapers brought human suffering home into every household in a concrete form and everybody understood and responded. Public sentiment demanded help and those who did not give from sympathy gave because they could not withstand public sentiment.

All of those calamities combined are not as great as is the calamity of tuberculosis in our country every year, for that year. The loss of life for a single year from tuberculosis is fifty times greater than it was in all of those calamities. The amount of suffering from tuberculosis for a single year is greater than was the total suffering in all of those calamities. There was not a form of human suffering or human misery precipitated by those calamities which is not duplicated many times over every year by tuberculosis. The rending of family ties, the contemplation of suffering in those who are helpless and dependent, hunger, exposure to weather, overhanging disaster, despair, everything that makes for human misery and degradation occurs in tuberculosis in as great a degree during every year as it did in any and all of those disasters. The only item which is smaller than that in the calamities mentioned is money value and even in this item the loss to public wealth annually amounts to many millions of dollars. It can be safely said that the loss to public wealth in the United States alone from tuberculosis directly and indirectly is not less than fifty million dollars annually.

Could the disastrous influence of tuberculosis upon any community be presented to the public in a concrete form in the manner in which, for instance, the San Francisco earthquake was presented; could all the consumptives of the land be marshalled into line and their sufferings be thus presented to the world at one glance; could the miseries, degradations, degeneracy and crime which grow out of tuberculosis throughout the entire country be shown to the public in concrete form, the shock would be as great as that coming from any great disaster, and the response for the amelioration of the sufferings would be as generous as that which the world has just witnessed for California. It requires a shock of this kind to arouse public sentiment. With the tuberculosis problem it is a question of bringing the facts in the case before the public in such a way that the average mind is able to grasp them and interpret them. The facts are enormous enough

and terrible enough to produce the shock but the difficulty lies in bringing them before the public.

The press has been a mighty influence in arousing public sentiment and stimulating generosity during public calamities. Except for the press such an outpouring of charity as we have recently witnessed would not be possible. The public press is keenly awake to anything which is for the public good. Newspapers and magazines have a keen scent for new ideas which will advance civilization, but like all human agencies, they must understand them and see value in them for the public. Could we make it clear to all newspaper men and magazine writers in the land what the crusade against tuberculosis means we undoubtedly would have the constant and zealous support of all of them in this campaign. The press has already done a very great deal for the crusade and would have done more had the facts been properly presented to it. This association can spend money in no better way than by organizing a press bureau for the purpose of supplying newspapers and magazines with correct information in all matters appertaining to the crusade against tuberculosis. We ought to establish such a bureau.

One of the surprises of the crusade against tuberculosis is that it has not attracted more wealthy men. Money is valued by men only for what it enables them to do. At the bottom of every man's ambition is the wish to do some good, and it can be laid down as a fundamental principle that every man according to his own interpretation of things has for his ultimate object the accomplishment of something for the betterment of others. Quite naturally wealthy men seek outlets for the expenditure of their money along those lines which appeal to them individually. One can only take pleasure in an action based upon one's own intelligence and understanding. To give money because somebody asks for it or without approving of the object to which the money is to be put does not give pleasure. Men give to an object which they desire to see accomplished, even though it is accomplished through someone else, but do not give to an object in which they have no interest. Few wealthy men have so far given to the crusade against tuberculosis because few have an intelligent idea of what it means. The way to reach them and secure their aid is to make known to them what the crusade means. Demonstrate to them that tuberculosis can be stamped out; that millions of human lives can be saved by stamping it out; that the human race can be elevated and

improved by it; that civilization can be advanced by it; and that the sum total of human happiness can be increased by it; and they will give all the money that is necessary for the crusade.

Our association has been called into existence to direct the forces at hand and to crystallize new ones. We have much to do in both directions. Much energy is wasted at present and some is actually expended injuriously. Men who know very little about tuberculosis are rushing into the work often with more zeal than prudence; and men with proper knowledge are unable to accomplish results for want of support. We must seek to moderate on the one hand and to help out on the other. We probably can accomplish both ends best by supplying information to all. Mistakes are usually made through ignorance and lack of support comes from the same cause. We should have a bureau of information for this purpose. Such a bureau should be able to give authentic information upon any phase of tuberculosis to all inquirers and especially to health officers. It should be able to draw up ordinances and laws bearing upon prevention of tuberculosis when requested to do so, and should have ready for distribution forms of acts of appropriation, deeds of trust, bequests, and documents of every kind which require technical knowledge. It should also have on hand plans of all kinds of buildings which are necessary for the treatment and prevention of tuberculosis and be ready to give advice upon the establishment of dispensaries, hospitals and sanatoria. It should be able to give information on preventive measure supplies and methods of disinfection and should be equipped to help every local movement in those matters in which expert knowledge is required.

A lecture bureau should also be established by the association. Lecturers on the various phases of tuberculosis are needed in all parts of the country for educational purposes and local workers are often at a loss to know where to get them. The expense of sending such lecturers could in part be borne by the localities in which these lectures are given and in part by the association. The association ought to have complete sets of lantern slides illustrating every phase of tuberculosis which it could loan out to different places. It ought even to have lectures written out to suit the illustrations and send these to be delivered by local men. Such lectures ought to be given before all kinds of audiences and as far as possible should be adapted to such audiences.

It might be well perhaps, in the interest of enthusiasm, for the asso-

ciation to adopt the double red cross as the emblem of the crusade and to have its members wear it on a button. The double red cross has already been adopted as the emblem of the crusade by Germany and France, but so far has been used chiefly on stationery and publications. It was used on the badges worn by the members of the recent International Congress on Tuberculosis in Paris, but so far as I know has not been used anywhere else for such a purpose. The wearing of a button of this kind might be made a useful means of education. It would stimulate inquiry and perhaps help to create public sentiment in favor of the cause.

We have a grand work before us and the world is prepared for it. The forces are lying dormant waiting for crystallization. It is our function to crystallize them. Will we prove ourselves worthy of the trust which Providence has placed in our keeping? Who can contemplate the self-sacrifice and enthusiasm of those engaged in the cause and doubt it?

IMMUNITY IN TUBERCULOSIS

By Simon Flexner, M.D.

New York

I cannot begin this address without delaying a moment to testify to my sense of the great honor which has been conferred upon me by your invitation. Neither can I proceed with it until I have expressed to you my conviction that there are persons present in this audience whose scientific work on tuberculosis make them far abler than I to discuss the complex problem of immunity in tuberculosis. My work in bacteriology in the past has not led me to an especial consideration of the highly important problem of the prevention and cure of tuberculosis, and I can therefore account in no other way for my selection to address you this evening than that you desired this topic presented to you from the point of view of one who has done some work in the general field of modern bacteriology.

The modern study of tuberculosis, as you know, begins with the generation which immediately preceded the epoch-making discoveries of Koch. It may, I think, be said with justice that this study was inaugurated by the first purposeful transmission by inoculation of the disease from animal to animal. For whatever may have been the speculations upon the infectious and transmissible character of the disease before this demonstration, yet the demonstration was necessary before further steps in the elucidation of the cause and prevention of the disease could be taken. Koch in his masterful monograph gives the credit of successful inoculation to Klencke, who in the year 1843 succeeded in inducing an extensive tuberculosis of the lungs and liver in rabbits by inoculations with portions of miliary and infiltrating tubercles from man. Klencke, after accomplishing this result, did not continue his investigations and they were consequently soon forgotten. In the meantime Villemin's experimental investigations were begun and pursued to a successful termination. He inoculated not only with

tubercular material from human beings, but also from cases of bovine tuberculosis, and he seemed to have proven experimentally the identity of the latter disease with human tuberculosis. Villemin's researches, from the number of his experiments, the careful manner in which they were carried out and the employment of suitable control experiments, appeared to decide the question in favor of the infective theory of tuberculosis. The numerous workers who repeated Villemin's experiments, after the same or modified methods, arrived at very contradictory results. The opponents of the infective theory strove to prove that true tuberculosis could be induced by inoculation with *non-tubercular* material. To the decision of this question Cohnheim and Salomonsen contributed largely by selecting for inoculation the anterior chamber of a rabbit's eye. The great advantage which this method possesses over all others arises from the fact that the course of a successful tubercular inoculation can be watched throughout by the experimenter until the pathological process has advanced so far that the whole organism—the neighboring lymphatic glands, the lungs, spleen, liver and kidneys—become tuberculous. A further point in favor of this method of inoculation is that spontanous tuberculosis of the eye has never been observed in rabbits. It was reserved for the genius of Robert Koch to discover nearly twenty years later, in 1882, by the employment first of an original staining method the tubercle bacillus in sections of tuberculous organs, and next by the use of a special method of artificial cultivation to secure growths of the bacillus free from all admixture with extraneous matter. With these pure cultivations he succeeded, as you well know, in reproducing in certain domestic animals all the characteristic appearances of tuberculosis in man. Furthermore, Koch's studies of this period convinced him of the unity of causation of the various tubercular affections met with in man and also of those met with in the common domestic animals. Refusing to be daunted by the fact that tuberculosis tends to appear under different aspects in each species, and directing his attention not upon the gross appearances of the disease but focusing it upon the microscopical appearances of the primary tubercle, which as he said recur with typical regularity in all the different processes in man, Koch recognized the essential identity of the apparently widely different forms of tuberculosis in the various species of animals. It does not detract from the immense value of his work that Koch failed to distinguish between the tubercle bacilli isolated from the tubercular tissue in fowls,

cattle and man. This failure was by no means accidental, for the possibility of the existence of differences in nature of the cultures depending upon their origins was clearly in his mind. Many of you will recall the long list of cultures which is given in the paper on tuberculosis published in 1884. In regard to this list Koch says: "It may cause some surprise that so relatively large a number of cultures was set on foot when a few would have sufficed for observing the behavior of bacilli in cultures. It seemed to me, however, not improbable that though bacilli from varying forms of tuberculosis—perlsucht, lupus, phthisis, etc.—presented no differences microscopically, yet that in cultures differences might become apparent between bacilli from different sources. But although I devoted the greatest attention to this point, I could find nothing of the kind. In all the cultures, whether taken from miliary tubercles, lupus or perlsucht, the tubercle bacilli behaved exactly the same."

Our knowledge of the nature of the tubercle bacillus has been increased until at this time several distinct kinds are recognized. These may conveniently be classified according to their chief sources into human, bovine, and avian tubercle bacilli and into so-called tubercle bacilli of cold-blooded animals. This last group of bacilli, which will detain us only a short time, differs greatly from the other varieties, as can readily be seen when the fact is recalled that the high temperatures—temperatures approaching blood heat—which are required for the growth of the mammalian and avian bacilli, quite preclude their multiplication under conditions of ordinary external nature. Hence they are not adapted to a life outside the living body except as cultivated artificially at this relatively high temperature. In man's conflict with tuberculosis this fact is of the greatest service, since by reason of it he is enabled to disregard the danger of any increase in tubercle bacilli outside the animal body. The relatively low temperatures at which the tubercle bacilli of cold-blooded animals develop adapt them, indeed, to an independent existence; but as they are wholly devoid of power to cause disease in warm-blooded animals and as they would appear to have a restricted dissemination even among cold-blooded species, they are of comparatively small importance.

Of far greater consequence is the question whether the disparity which exists between the several kinds of tubercle bacilli derived from warm-blooded animals is a wide one. This question, which at first sight may appear to be chiefly of academic interest, has, in reality, far-

reaching practical significance. The close relationship which man bears to domestic animals makes every fact of animal disease of high value to him. And in the case of no animal disease are facts of greater moment than in tuberculosis. Not only is the human race, by reason of its dependence upon the animal kingdom for food, work, etc., exposed to the diseases of animals which are transmissible to man, but domestic animals are also exposed to diseases of human beings. This correlative susceptibility may, therefore, co-operate to produce a vicious circle of events by which infection or the dangers of infection are kept alive and threatening. Hence it is that an effective solution of the problem of limitation of tuberculosis, whether by suppression outright, or by suppression through the induction of immunity, must take into account the degree to which tuberculous animals of different species, through direct or more remote association, are a source of danger to one another.

There is no longer any doubt that the avian tubercle bacillus departs considerably from the human and from the bovine types of bacilli. The early observations of the Italian investigators, Rivolta and Mafucci, have been confirmed and so extended as to give us a fairly comprehensive knowledge of the capacities for pathogenic action, upon different animal species, of the avian bacilli. At the same time painstaking studies of the degree to which birds are subject to inoculation with pure cultures of tubercle bacilli of human origin support the view of diversity in type of bacilli and susceptibility of species. And yet, while fowl react only with slight local lesions, as a rule, to inoculations of tubercle bacilli of human origin, certain mammals have proven themselves fairly subject to experimental inoculation with avian bacilli. While the guinea-pig, otherwise so sensitive to inoculation tuberculosis with the mammalian bacilli, is relatively resistant to the avian variety, the rabbit, which exhibits a marked degree of refractoriness to the human bacilli, succumbs quite readily to the avian bacilli. It is, however, worth noting that the reactions in the rabbit which avian tubercle bacilli call forth do not conform to those observed in tuberculosis in general; there is absence of typical tubercles and caseation, and the chief pathological alterations observed are found in connection with the enlarged spleen.

The literature on tuberculosis contains a small number of references to the cultivation from human subjects of the avian tubercle bacillus. From our present knowledge it may be postulated that avian tubercle

bacilli occur rarely in man. Rabinowitsch has, indeed, recently emphasized the occasional occurrence of the avian bacilli in cattle, swine, horses and monkeys; but they constitute a small source of danger in the spread of tuberculous disease among mammals. The parrot because of its use as a pet and of its susceptibility to the avian bacillus on the one hand, and of the human bacillus on the other, is a greater menace to public welfare.

The subject of bovine tuberculosis and of bovine tubercle bacilli is among the most important of all the questions relating to the suppression of tuberculosis. The admirable studies of Theobald Smith established the distinction in type subsisting between certain bacilli of human and of bovine origin. We have come now to regard these types as separate and not to be transmuted, at least not readily under artificial conditions of cultivation, into each other. Into the disputed questions of variation due to environment I cannot afford to enter. But I would have you believe that transformations of avian, bovine and human bacilli into each other have probably not been accomplished by experimentation. The cultivation of one variety of bacilli in the body of an alien species has been said to alter profoundly the properties of the bacilli; but the observations upon this point are in my opinion far from convincing. The mere fact that avian and bovine varieties of bacilli preserve their peculiar properties when occurring naturally in the diseased body of an alien species—man for example—tends to discredit the experimental transmutations referred to.

Bovine tubercle bacilli are characterized, as ascertained by Smith, by a greater degree of pathogenic power for mammals in general than human bacilli, with which fact is correlated certain peculiarities of cultural and physiological properties serving further to separate the bovine from the human bacilli. The bacilli of mammalian origin are, perhaps, closely related and less removed from each other by the sum of their properties than they are from the avian bacillus. With the few exceptions mentioned all forms of mammalian tuberculosis are caused either by the human or the bovine bacillus.

In view of the general fact that the bovine bacilli show a greater degree of pathogenic action for the lower mammals than the human bacilli, it was natural to asume that bovine bacilli would be powerfully pathogenic for man also. To test this probability directly by experiment is, of course, not permissible. But the belief that tuberculosis in cattle is a menace to man is expressed in the many regulations by

which it is aimed to control and prevent the use as food of products derived from tuberculous animals. It was not until Koch's address was delivered in 1901 that any serious doubt existed in the minds of sanitarians and pathologists that tuberculous cattle offered a source of danger to man. The specific knowledge which has accumulated since that date has served to establish the transmissibility in some degree of bovine tuberculosis to the human subject. The inherent difficulty and tediousness of the investigation of the specific types of tubercle bacilli existing in human cases of tuberculosis necessarily limit the total number of instances in which it has been established, beyond peradventure, that the bovine type of bacillus does occur in tuberculous processes in man. In this country the responsibility of refuting the too general statement of Koch has fallen chiefly upon Ravenel and Theobald Smith, whose admirable studies in this direction are of a convincing nature.

If we pause for a moment to consider upon what data Koch based his statement of the independence and non-communicability of tuberculosis in cattle and man, we shall appreciate that in so far as he dealt with established facts and not hypothesis he had long been anticipated. That cattle are highly resistant to infection with tuberculous material and tubercle cultures obtained from human subjects can be concluded from the early experiments of Baumgarten, Sidney Martin, Frothingham and Dinwiddie. The most conclusive evidence upon this subject is contained in Theobald Smith's paper of 1898, in which he summarizes his experiments by stating that " putting all the facts obtained by experiments on cattle together, it would seem as though the sputum bacillus cannot gain lodgment in cattle through the ordinary channels." In view of these facts it is not surprising to find that Koch and Schütz later failed to produce marked or general tubercular infection of cattle by feeding or inoculating directly into the circulation, tuberculous materials and cultures of tubercle bacilli of human origin. That this result does not dispose of the entire question at issue, but leaves open the important consideration of the implantation of the more virulent bovine bacilli upon man was, of course, present in Koch's mind, and was met by him by emphasizing the infrequency with which primary intestinal tuberculosis, which is the form of tuberculosis presumably arising from ingested virulent tubercle bacilli, is encountered in human beings. The reports which have appeared since have tended to show that primary tuberculosis of the abdominal viscera, especially in children, is not so infrequent as Koch believed it, and the researches in-

spired by Koch's address have brought out the important fact, now based upon actual observation under the microscope, that tubercle bacilli may pass through the intact intestinal wall and reach, by means of the lymph current, the mesenteric glands; and have made it seem probable, also, that by entering or being carried into the blood vessels in the intestine the bacilli may be carried to the lungs. When all the known facts of food infection in tuberculosis are assembled they make quite an imposing array, for they indicate, quite in opposition to the exclusive view expressed by Koch, that tubercle bacilli entering the body with food may be implanted upon the mucous membrane of the mouth from which, probably, chiefly in the region of the tonsils, they may be carried to the lymphatic glands of the neck and adjacent parts, where they develop and produce tubercular disease; or they may become implanted upon the intestinal mucosa and pass the epithelial barrier without first causing disease there and set up lesions in the mesenteric lymph nodes or even be transported by the blood or lymph to the distant lungs, or they may first multiply in the intestine, cause tubercular disease there, and then migrate further, involving the abdominal and thoracic organs.

If I have seemed to tarry too long over this aspect of my subject I will ask you to consider, for a moment, in how far the endeavor to limit the spread of tuberculosis among the human race must be influenced by the avenues of infection to which the race is exposed. If we side with Koch in the view expressed in 1901 and reiterated just the other day in his Nobel-prize address that, as he says, human tuberculosis and tuberculosis in cattle are so distinct from each other that the latter is not to be feared as transmissible to man, at least, as his last utterance puts it, not in a form which comes in consideration in regard to tuberculosis as a "*Volkskrankheit*," or race disease, then it is only necessary to direct efforts to the suppression of tubercle bacilli of human origin. For, if the danger of infection of surroundings and healthy individuals is limited to the expectoration of persons suffering from tuberculosis of the lungs and upper air passages, the problem before us, while still very large, is less by a considerable amount than if there must also be taken into account the widely prevalent disease among cattle, swine and other domestic animals. While I do not pretend to speak in terms of great authority, yet it would seem to me that the time is not yet ripe to disregard, in attempting to suppress tuberculosis, the disease in domestic animals. Greatly as I sympathize with the

active propaganda which is being made by instruction and material help to protect tuberculous human beings from injuring themselves and others, and greatly as I hope to see promoted the means of caring for the tuberculous in sanitaria, etc., yet I hope that there may occur, at this time, no relaxation in the efforts being made to control the spread of tuberculosis among cattle and to prevent the consumption of infected milk and flesh by man and other animals. That, on the other hand, the suppression completely of tuberculosis among cattle would not be followed by a great reduction in the morbidity due to tuberculosis in man is shown by Kitasato's statistics from Japan. In that country the human disease prevailed with its usual activity at a time when the cattle disease, owing to the absence of cattle, was unknown and milk formed no appreciable element in the food of children.

In dealing with the complex problem of tuberculosis—a problem whose difficulties enlarge with the continued growth in size of cities—we are materially assisted by the knowledge of the manner in which the virus of tubercle is separated from the diseased body, the conditions of its contamination of our environment, and the avenues through which it endeavors to enter the healthy body. Though it is scarcely to be hoped that a time will arrive when tuberculosis will have become, through precautions against infection, as rare as are to-day small pox and typhus fever, yet it is a most hopeful result of the crusade against tuberculosis that a marked reduction in the mortality, and probably in the incidence of the disease has been going on in some countries—as, for instance, in England—for forty years. In New York the system organized by Biggs has brought about a reduction since 1886 of 35 per cent. in the mortality of the disease; and while in Prussia the mortality was stationary in the decade from 1876 to 1886, since that time a reduction of more than 30 per cent. has been noted. These figures show what may be accomplished in reducing the dangers of infection with tuberculosis by a regime of education, improved conditions of living for the poorer classes, and the segregation in hospitals and sanitaria of any considerable number of the infective tuberculous during the most dangerous period of the disease.

The discovery of the microbic agent of tuberculosis naturally awakened the hope that a specific means of treating and, possibly, of preventing tuberculosis might now be found. The early years following the cultivation of the tubercle bacillis saw no realization of this hope, and to-day we are still far from the desired goal. However, the

prodigious labor which has been expended in the search for a means of protection against infection with the tubercle poison has not been wholly devoid of results.

In an address of this kind it is not practicable to deal with the separate contributions, in detail, which the many workers have made to the subject of immunity in tuberculosis. The most that can be accomplished is to bring together the most important results of all the workers and, after having assembled them, to judge of their value and to consider, possibly, in what important respects they are still imperfect. I cannot do better, at the beginning, than to remind you that the successful point of departure has been the discovery that variations in type and in virulence exist among tubercle bacilli. The earlier view which taught that the tubercle bacillus is a micro-organism of uniform and fixed virulence has been shown to be erroneous, first by the discovery of variations according to certain origins, and second by a gradual decline in pathogenic power suffered by certain strains through long cultivation outside the animal body.

The animals which have been of special use for tests of immunity are rabbits, cattle and goats. The guinea-pig, which furnishes an almost ideal animal for the detection of tuberculosis, because of the sensitiveness of its reaction to inoculations with tubercular material, fails for the same reason to be a highly suitable animal in which to carry out tests of immunity; and yet it has been employed with some success.

The first important contribution to the subjejct of experimental immunity in tuberculosis was made by Koch in connection with his researches on tuberculin—a product of the growth in broth of tubercle bacilli, freed from the bacilli and concentrated. In spite of the failure of tuberculin to bring about a favorable issue in all cases of human tuberculosis in which it is administered, it still remains a useful, perhaps the most useful, strictly medicinal agent employed for the treatment of tuberculosis. But the sum of its useful properties is not embraced in its employment as a therapeutic substance: it is also a diagnostic agent of high value, and its action upon the tuberculous organism is so specific and remarkable that it has proven itself of the greatest importance and aid in the effort to unravel the complicated series of biological phenomena which constitute the tubercular state.

It is possible to increase somewhat the resistance of animals to tubercular infection by previous treatment of tuberculin; but this increase is not remarkable. It is possible to bring about arrest of the tubercular

process in the infected organism by means of tuberculin; and in some instances this arrest leads, through the changes induced in the tuberculous tissue by means of the tuberculin injections, directly to cure or indirectly through an increased power of resistance and attack on the part of the forces of the organism to eventual cure. But a high and lasting degree of immunity has never been secured by the use of tuberculin. This fact, disappointing as it was at first, is now easily explicable. Tuberculin does not represent the entire series of forces contained in the bacilli which the body has to resist in preserving itself from infection with tubercular poison. The peculiar principles contained in tuberculin are, indeed, not highly toxic for the normal individual; and our experience in securing immunity to micro-parasites and their products has taught us that where no reaction or response to the introduction of the foreign poison is called forth, no degree of protection to larger doses or more virulent poisons of the same nature is to be expected. Toxic as is tuberculin to the tuberculous organism, it is almost innocuous to the tubercle-free body. It has been found, in keeping with this distinction, that the normal animal shows after tuberculin treatment evidence of the minimal production of the neutralizing or antibody for the tuberculin, which were tuberculin a direct poison for the tissues, would probably be produced in larger amounts. On account of this absence of action on the normal organism it has been thought that the active principle in tuberculin does not exist in a free state, but occurs in some combination, from which the tuberculous but not the non-tuberculous organism can free it, and that the separation takes place in the tubercular foci upon which the specific action of the poison is directly exerted. If this view is correct then the failure of tuberculin to exercise any profound action on the healthy organism is easily grasped.

Increased knowledge of bacterial infection and immunity has taught us that in case of bacteria, which invade the depth of the body and produce their peculiar effects by reason of their immediate presence, we cannot expect to achieve marked immunity through the use of the soluble gross-products of the parasites. The reaction of the body to the invasion depends not upon the presence in the invader of one set of toxic principles but of many, some of which are contained in the solid substance of the micro-parasite and do not go over into the fluids in which they multiply. Thus it has been found, in case of certain bacteria, that a degree of immunity or protection which it is impossible to

obtain even after very prolonged treatment with the fluid portions of cultures, can be secured quickly when small quantities of the living or even dead micro-organisms are injected into the body. A high degree of bacterial immunity has been secured up to now for a small number of micro-organisms by vaccination—by the method introduced by Pasteur —for several animal diseases, notably anthrax or splenic fever, fowl-cholera and black-leg. In these cases the living attenuated micro-organisms are employed.

Neither lasting nor marked immunity in tuberculosis can be obtained by the inoculation of cultures of tubercle bacilli killed by heat, sunlight or other agency. Dead tubercle bacilli are poisonous and bring out a striking reaction of the organism, but this reaction does not confer immunity to subsequent inoculations of the living germ. It may well be that the dead bacilli, especially if reduced to impalpable powder so as to facilitate absorption, may after injection raise the powers of resistance in the organic forces, although the height of the sustained forces is not sufficient to enable the body to throw off completely the living infecting organism. It is easy to prove that the animal organism is modified by the development within it of the tubercle bacilli; and merely disposing of dead bacilli increases its power of reaction against a second injection of dead tubercle bacilli; the second action being much more vigorous than the first (Theobald Smith). The experiments of Koch which immediately preceded the discovery of tuberculin clearly demonstrated that tuberculous guinea-pigs into which tubercle bacilli are reintroduced subcutaneously react in a very especial manner. An active inflammatory process develops about the site of second inoculation which eventually brings about the expulsion of bacilli with the exudations; a voluminous slough forms, which, when shed, carries with it a large number of bacilli; and this shedding is followed neither by the formation of a permanent ulcer nor hypertrophy of the neighboring glands, a regular result of the primary inoculation. The tubercular organism reacts in the same manner to dead as to living bacilli; the tuberculous animal has acquired immunity against reinfection or reintoxication by the tuberculous virus, which, however, in no way prevents the first inoculation from becoming generalized and setting up a tuberculosis of almost all the organisms.

If we attempt an interpretation of these phenomena we can conclude that the organism once it is poisoned with tubercle virus becomes super-sensitive to the tubercle poison. This super-sensitiveness is displayed

in the manner of reaction upon re-inoculation of the tuberculous organism to tuberculin and to dead and living tubercle bacilli. But the organism poisoned with dead tubercle bacilli is not in reality tuberculous; it is, however, sensitized. In keeping with this distinction it can be said that while the tuberculous organism has acquired a degree of immunity to reinfection, the organism merely poisoned with tubercle bacilli has failed to develop this state of resistance.

The experimental results, which I shall relate to you, upon which are based our belief in the artificial production of immunity to tuberculosis, were all obtained by the use of living bacilli. It would, therefore, seem as if in the course of their residence and development within the body the immunizing organisms behave differently from those in artificial cultivations. This difference in behavior could be accounted for on the supposition that under conditions of parasitic life, surrounded as the bacilli are with complex fluids and more complex cells, they form, in their growth, products which either are distinct from those which are formed by them in cultures, or these products, in statu nascendi, are acted upon and modified by the active and labile ferments in the fluids and protoplasm of cells, with which the growth-products must come into immediate contact. Professor Welch, to whom this variation in behavior of bacteria under parasitic and saprophytic states of existence was fully apparent, endeavored a few years ago in his Huxley Lecture to explain the difference in activity of bacteria growing within and outside the body by supposing that in the body they are induced to secrete substances the stimulus to the production of which is absent in the culture tube. However this may be, it is evident that the only form of immunity in tuberculosis which deserves the name has been obtained by the employment for inoculation of living cultures of the tubercle bacillus.

Although the earliest experiments, which had for their object the production of immunity in small animals by means of previous inoculation of products of the growth and of attenuated cultures of the tubercle bacillus, were published in 1890 (Martin and Grancher, Courmont and Dor) yet, I think, the first really promising, because successful, a chievements of this end were made by Trudeau in 1902 and 1903 and by de Schweinitz in 1904.

Trudeau protected rabbits from virulent tubercle bacilli by first injecting them with a culture of bird tubercle bacilli, the subsequent injection of virulent mammalian bacilli being made into the anterior cham-

ber of the eye. The rabbits, to be protected, were twice injected subcutaneously at intervals of twenty-one days with cultures of the avian bacilli. About one in four of the rabbits died within three months, profoundly emaciated, but without tubercular lesions. The remaining animals recovered and were apparently in good health, when, with an equal number of controls, they were inoculated in the eye with a culture of mammalian tubercle bacilli. The results are instructive: In the controls little or no irritation following the operation is observed and the eye remains quiescent or nearly so for about two weeks, when the changes described in the early part of this address manifest themselves. After a few weeks general inflammation of the structures of the eye develops, the inoculation wound becomes cheesy, and the eye is more or less completely destroyed. The disease, however, remains usually localized in the eye for many months, and may remain there permanently, depending upon the virulence and number of the bacilli injected.

In the vaccinated animals, on the contrary, the introduction of the mammalian bacilli at once gives rise to a marked degree of irritation. From the second to the fifth day the vessels of the conjunctiva become engorged, and evidences of marked inflammation appear in the anterior chamber and on the iris (reaction of immunity). However, at the end of the second to the third week, when the eyes of the controls begin to show progressive and steadily increasing evidence of inflammatory reaction, the irritation in those of the vaccinated animals begins slowly to subside and the eyes to mend. In from six to twelve weeks, in the successful cases, all irritation has disappeared and the eyes present only the evidences of traumatism and inflammation. This experiment leaves no doubt of the protective influence exerted by the first inoculations of the avian bacilli and clearly establishes that related cultures of tubercle bacilli of moderate virulence for an animal species can afford protection to subsequent inoculation with special and more pathogenic strains of the bacillus. Notwithstanding the fact that as Dr. Trudeau records some of the protected animals slowly relapse and the disease resumes its progress, although by almost imperceptible stages, the experiment still shows that protection, not absolute immunity from tuberculosis, may be obtained in rabbits by a species of vaccination.

De Schweinitz in 1894 reported certain experiments which he made on guinea-pigs and cattle. He inoculated the former with a culture of tubercle bacilli of human origin cultivated for about twenty generations in broth. This culture was of a low grade of virulence for these ani-

mals, but it served to protect them to such an extent that when they were afterwards inoculated with tuberculous material from a cow they remained healthy, while control pigs injected with the same material became tuberculous and succumbed in about seven weeks. De Schweinitz injected large quantities of human tubercle bacilli into cattle—beneath the skin, into the peritoneal cavity, and into the circulation —without injury.

I may, at this time, digress for a moment and leave the more strictly chronological method of presentation to allude to the set of experiments on the protection of guinea-pigs from tuberculosis which Trudeau reported to the National Tuberculosis Association at its last meeting. The special merit of this experiment is that it shows the existence of a connection between virulence and infectivity in the germ and its capacity to confer immunity. Unless the bacillus has the power to gain some foothold in the body it affords no protection; if on account of high pathogenic power or virulence, it easily gains a foothold, then it brings about infection. To choose a culture of tubercle bacilli of just the right grade of virulence is one of the conditions, apparently, of successful experiment, as it must also be, in view of this fact, one of the difficulties of the method. The same difficulty has been encountered in the practical carrying out of this method of immunization in cattle. Several series of guinea-pigs were inoculated with tubercle bacilli as follows: (*a*) with dead bacilli, (*b*) with living bacilli from cold-blooded animals, (*c*) with a culture of human bacilli cultivated artificially for more than twenty years, which produces on inoculation no appreciable local lesions and never tends to generalize; and (*d*) another human culture cultivated artificially for more than fourteen years, which still causes in all the pigs slightly enlarged inguinal glands near the site of inoculation, and occasionally brings about slight caseation of the nodes with a tendency to partial generalization of the virus. The dead bacilli and the bacilli from cold-blooded species gave no protection; the second human culture, by reason of its greater invasive properties, protects better than the first, which is almost devoid of power to grow in the animal body. In no case, however, was the growth of the virulent bacilli wholly suppressed.

In man the question of acquired immunity has been answered by many authorities, as far as the main considerations go, in the negative. A large number of well-observed facts demonstrate that a person who has suffered from localized tuberculosis of the lymph glands—scrofula

so-called—or other form of local tuberculosis, cannot count upon an immunity from pulmonary tuberculosis. And yet it can, I think, be shown by reference to statistics that in man there exists a refractory condition which becomes increased after infection, since the number of persons who have been the victims, at some period of their life, of a tuberculous infection, is very large in comparison with the number who die of this disease, or the even larger number who develop severe forms of it. Hirsch gives the mortality from tuberculosis as compared with deaths from all other causes as 3 : 22, in other words, tuberculosis claims as victims of death 1 in every 7 persons. This proportion does not, however, express the morbidity from tuberculosis which is, in reality, far greater than these figures indicate. It is difficult to secure by vital statistics reliable data of the incidence of tuberculosis; but trustworthy observation made at autopsies upon human beings indicates that as many as 90 per cent. of persons, dying from all causes, have at some period of their life been the victims of a tubercular infection. In far the greater number of instances the disease remains fixed in the bronchial or other lymphatic glands or the apex of the lungs, and exerts no injurious effect upon the organism as a whole. We may, therefore, fairly conclude that the human organism possesses a strong inherent tendency to overcome infection with the tubercle bacillus. So much can be safely predicated. But whether the suppression of a local infection, such as I have described, gives an increased capacity for overcoming subsequently invading tubercle bacilli remains for the present an open question. It is certainly not disproven by the facts cited; and some authorities hold fast by the belief that a degree of immunity to tuberculosis may be acquired by man.

In the year 1901, on December 12, on the occasion of his acceptance of one of the Nobel prizes, Behring announced that he was engaged upon the study of artificial immunization of cattle to tuberculosis. In this address the claim was made that a method had been perfected whereby it was possible to vaccinate cattle successfully against tuberculosis. These experiments consisted in the endeavor to immunize cattle by means of tuberculin, other toxins, so-called, from the tubercle bacillus, dead tubercle bacilli, bacilli weakened with chemicals, and living, active cultures of the tubercle bacillus. In the four years which have elapsed since this announcement was made a series of monographic papers bearing on this subject has appeared from Behring's laboratory in Marburg. The plan of immunization has, in this time, undergone

a number of modifications until now it consists in the inoculation intravenously of young cattle—calves twelve weeks old preferably—with a standard human culture, which is now furnished commercially. A second inoculation of an increased quantity of this culture is injected three months later. Cattle treated in this way are regarded as highly immune and are denominated by Behring as "Jennerized." If to them a dose of a virulent bovine culture of tubercle bacilli is given, no permanently bad results follow, although an equal dose of the virulent culture will cause, in an unvaccinated animal, the development of generalized tuberculosis leading, in a few weeks, to death.

In his endeavor to find a culture of the tubercle bacillus which would fulfill the requirement of producing a transient illness and leave protection behind, Behring discovered that not all tubercle bacilli of human origin were without danger to cattle inoculated with them. We were, indeed, not unprepared for this announcement, since, in the first place, we had learned that in some instances tubercle bacilli of the bovine type have been cultivated from examples of human tuberculosis, and, on the other, that not all the bacilli, of any type, exhibit equal degrees of virulence. The culture employed by Behring, although it has now been employed to inoculate several thousand cattle, is said never to have produced severe disturbances of health; even when animals already tuberculous are inoculated the results are not serious: fever lasting several days sets in, the animals may cough, and they may eat less and lose somewhat in weight, but even they return to what is for them the normal.

It would appear that McFadyean is entitled to the credit of the discovery equally with Behring of the immunization of cattle from tuberculosis; and, indeed, there is reason to believe that his results even anticipated those of Behring. By using for injection first tuberculin and then in succession tuberculin and tuberculous material containing bovine and possibly human tubercle bacilli, McFadyean succeeded in increasing the resistance of several cattle to artificial tubercular infection.

Pearson and Gilliland, in 1902, in this country published accounts of some experiments which they carried out upon the immunization of cattle from tuberculosis. They employed a culture of human tubercle bacilli for producing immunity and found that subsequently the protected animals, as compared with the controls, which all succumbed to the virulent inoculation, either developed no lesions or very incon-

siderable ones upon being given large quantities of highly pathogenic bovine cultures. As far as I know these experimenters are the only investigators who have endeavored to carry the principles of the method a step farther, so as to bring about arrest of the disease in cattle already tuberculous. While it is unlikely that such a therapeutic use of "vaccination" will ever be made in veterinary practice, the facts are of considerable theoretical interest, especially in view of the somewhat similar means employed to arrest tuberculosis in man.

The immense importance to scientific agriculture of the matter of immunization of cattle from tuberculosis and the even greater collateral interest which the subject has for man as enlarging the possibilities of immunity even for him, has led to a discussion on the priority of the discovery between Neufeld, a pupil of Koch, and Behring. It would appear from Neufeld's writings that while working under Koch's direction, he ascertained as early as 1900–1901 that large animals—donkeys chiefly, but cattle also—could be protected from artificial infection with virulent tubercle bacilli, always fatal to control animals, by previous treatment with tubercle vaccine, of which several different preparations of the tubercle bacillus were studied. It is not within the scope of this address to apportion the credit of priority; but in any case, assuming the facts to be as stated by the contestants, McFadyean should receive as great credit as either of the others, if not the chief credit. The principle which all the investigators employed is not new in experimental medicine, but has come to us from the genius of Pasteur. It may, however, be said that our knowledge of the tubercle bacillus and its varying activities, had by the year 1900 become so much enlarged that the possibility of putting the facts of the newly discovered properties to a practical test of immunity occurred to the several independent workers in bacteriology. There can, I think, be no doubt that Behring deserves the credit of making the protection of cattle from tuberculosis a feasible, practical object of study. This alone is a merit of no small order.

From the mere fact that cattle have been successfully protected against infection by the tubercle bacillus, even under the severest conditions of laboratory experiment, it cannot be concluded that they will be equally refractory when exposed to the natural sources and modes of infection. In the laboratory the virulent infectious agent is brought into the animal by injection, under the skin, into the serous cavities or into the circulation, which are avenues through which in the natural

disease infection rarely if ever takes place. And while this mode of introduction of the virulent bacilli into the body may, theoretically, be more severe than their introduction into the lungs with inhaled air, or into the stomach through infected stalls and food, yet the profound differences in the defences of the body with which the bacilli come into conflict, under these different circumstances, may, after all, determine the issue in a manner quite contrary to our expectations. It is, therefore, of the highest interest to learn that in their later tests Behring and his co-workers exposed vaccinated cattle to stalls and herds which were known to be badly infected, with the result that at the time of the report they had apparently escaped infection. I am enabled through the courtesy of a private communication from Dr. Pearson to state that cattle vaccinated by himself and Gilliland, which were kept for two years under natural conditions of infection, have not contracted tuberculosis, while the control animals, exposed to the same conditions, have all developed the disease, some dying spontaneously by reason of the severity of the infection. Dr. Pearson also informs me that their experiments indicate that the degree of resistance bears a rather definite relation to the number of vaccinations given the cattle. No cattle vaccinated three times with their standard vaccine—a living culture of tubercle bacilli of human origin—have developed tuberculous lesions even after two years severe exposure. In their experience, two injections of Behring's vaccine do not always suffice for such heavy exposures as they employed.

As regards the question of duration of the protection it may be said that Behring, basing his views on results of vaccination made three years before expressed the belief in 1904 that it would endure during the life of the animal. As young healthy cattle are vaccinated, before they fall victims to infected stalls and herds, it would seem as if infected herds might therefore gradually be replaced by healthy ones. The gain, this being true, would be almost incalculable to agriculture.

I am in the fortunate position of being able to bring before you a critical summary of the subjects just presented by one wholly conversant with its practical as well as its theoretical aspects. Through the courtesy of Dr. Leonard Pearson, I have been enabled to read the advance sheets of a review on immunization in tuberculosis which will soon be issued from the Phipp's Institute. Dr. Pearson concludes that there appears to be no doubt that different cultures of human bacilli have different immunizing values. Some cannot be used at all because

they are of too high and others, possibly, because they are of too low virulence for cattle. There is also need for comparison in immunizing value of fresh cultures and cultures that have been dried in vacuum and reduced to powder. Some observations appear clearly and strongly to indicate that the fresh cultures are preferable. Although it has been shown that vaccination can be practiced so as to be entirely harmless to the animals, yet, on the other hand, it is not always unattended with danger. What is the shortest and most economical procedure for the protection of cattle on a large scale is still to be established. Only prolonged observation of carefully recorded results of vaccinations practiced on a large scale can settle this point. The question of duration of immunity is still an open one. It has been shown that the immunity endures a year. To say, at the present stage of the studies, that it will last during the entire life of an animal is to make a statement for which there is no experimental proof. Modes of vaccination, as illustrated by the intervals between the successive injections, differ greatly. Behring recommends an interval of three months, while others have obtained a high degree of immunity by repeated injection at short intervals. As artificial immunity is relative and not absolute, it need not excite surprise that the immunity to the tubercle bacilli can be overcome by the injection of large quantities of active bacilli. What is desired in practice is a degree of immunity that will suffice to protect animals from acquiring the disease under natural, and consequently highly variable, conditions. In some herds, where the natural disease prevails in a mild form, a lower degree of immunity may suffice than in other herds in which the disease is more severe and widespread. We are, therefore, at the beginning of this complex and highly important subject. These are Dr. Pearson's conclusions.

There is another aspect of this subject which demands attention. When it is recalled that immunity in cattle is obtained by the injection of living human tubercle bacilli the question arises whether this procedure is wholly free from danger to the consumers later of the flesh and milk of these cattle. It would appear that the human bacilli do not excite in cattle the tubercular lesions, in which doubtless the bacilli are so enclosed as to be, to a considerable degree, protected from perishing. It is equally true that as the living micro-organism cannot be replaced by dead ones in bringing about immunity, the immunizing process is in some way bound up with their survival and even possibly with a restricted multiplication. Hence it is necessary that we ascertain, first,

how long the human bacilli survive in the organs of the vaccinated animals and, second, whether they are ever eliminated with the milk of cows. The observations already made upon these points are so few as at present not to be used for any scientific deductions. But before the method is too implicitly relied upon these questions should be answered.

It is an interesting subject of speculation as to what the result will be when cattle in general, and, possibly, man later, shall have been immunized to tuberculosis. Will the race of tubercle bacilli disappear in large measure from the world? This would indeed be a beneficent result. But Dr. Smith has pointed out in a recently delivered address that doubtless host and parasite eventually come to hold a kind of equilibrium to each other, and hence an increased degree of resistance in the former might tend to bring about that selection among the parasites through which races of greatly augmented power for invasion would be produced. If this were true, and he even suggests that the natural process of weeding out the weaker among the human race tends to this result, the parasite would try to keep up with the host as his resistance increased until a point was reached beyond which further enhancement of power was impossible. Would the higher animal or the lower vegetable organism finally claim the victory? We need perhaps at this moment not relax our efforts to achieve a practical immunity for man as well as for animals because of this future danger. I am not aware that the smallpox germ has increased measurably in virulence since vaccination became general, but I would also add that a century is a small period of time in the life history of any living organism.

Before closing this address I should like to refer briefly to the new interest which has been excited in the use of tuberculin in the treatment of human tuberculosis by reason of the application to the study of tuberculosis of a method introduced by E. A. Wright, of London, whereby it is held that the exact effect of the tuberculin injection can be measured and controlled. The method consists in the determination of the capacity of the blood leucocytes to take up tubercle bacilli when the blood and the bacilli are brought together outside the body in a test-tube. Wright and his pupils have worked out the normal power of the blood to cause the englobing of the bacilli; and they have noted a diminution of this capacity in the blood of many persons suffering from tuberculosis. They speak of this englobing capacity of the blood as "opsonic index," from the word meaning to prepare—to cater for;

since the bacilli must first be prepared by substances in the blood serum before they can be ingested by leucocytes. The injection of tuberculin, when cautiously done, tends to bring about a rise in the tuberculous, of the "opsonic index," which Wright believes is a measure of the good done, as an increase in immunizing substances in the blood is the cause of the rise. He also discovered that time is required for the occurrence of the rise and that the immediate result of the injection is a fall of the index—so-called negative phase. This latter must be permitted to pass away and be succeeded by the positive phase before another injection is given. Gradually the "opsonic index" is driven up in the cases that are favorable to the treatment.

I do not intend to discuss the value to the clinician of this interesting method and Wright's observations based upon it. The subject appears to me to be one of great intricacy and therefore to be approached in a spirit of proper criticism despite its evident allurements. My purpose in mentioning it at all is to bring again to your attention a method of exciting the tuberculous body to put forth an effort at self-immunization which is sometimes efficient to a marked degree. It is not the injected tuberculin that accomplishes directly the changes in the condition of the patient, for there already exists, doubtless, an excess of similar poisons in the tuberculous foci in the body. The healthy body, indeed, does not react in this manner and is not to be protected, enduringly, from tuberculous infection by a previous treatment with tuberculin. As Koch's phenomenon shows the tuberculous organism to have developed defences against subsequent tuberculous infection which the normal body does not possess in equal degree, the employment of tuberculin indicates that the diseased body can be aroused artificially to put forth a stronger effort than its unaided natural forces enable it to make, in order that the disease may be overcome. Herein resides a great principle, an immense power for good, and, consequently, a great hope for future progress in the rational and specific treatment of tuberculosis in man. Efficient efforts at suppression of the causes of tuberculosis, deeper knowledge of the principles of bacterial immunity, are the two forces which in time may stay the ravages of the "white death."

SOCIOLOGICAL SECTION.

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THE INFLUENCE OF A TUBERCULOSIS SANATORIUM ON THE VALUE OF SURROUNDING PROPERTY

By William H. Baldwin

Washington

This question is a practical one for it is admitted that many more sanatoriums for the treatment of tuberculosis are needed, and the first question to be decided in starting to build one is where to locate it. Since it is also admitted that sanatoria need not be confined to any particular climate or region there is a wide choice of locations, which will be affected by many considerations.

Foremost among them are those relating to the purpose for which the institution is started, requiring plenty of fresh air, a maximum of sunshine and freedom from smoke or dust. These all imply plenty of room, if not something like isolation; and many sanatoria are located at a distance from cities or even from any large town. The absence of the excitement caused by contact with numbers of people, and of the distractions incident to city life, favors successful treatment, but convenience of access for patients and facility for obtaining needed supplies must also be thought of, and these can best be secured near some city, often without foregoing the first requisites.

The subjective conditions upon which the accomplishment of the purpose of the institution depends being satisfactory, the next question is the value of the land required. Here, too, the isolated location has the advantage, for other things being equal the area of land needed can be bought for less money, or more land for the money available, than if a site is chosen to which the increment added by the proximity of improved and perhaps closely settled property has already attached. And in connection with this question of value we have also to take into account the effect such an institution will have upon the value of adjacent property, for the total cost to the community includes anything it may subtract from that.

In studying this effect two elements are to be distinguished, the influence of the building and improvements as such, and the purpose for which these are used.

It may be said that as a rule the erection of any building not in itself objectionable, by taking up a certain amount of land and so decreasing the remainder available, while increasing the purposes for which it may be used, enhances the value of the surrounding land and so is an advantage to it. The value of any piece of land is determined by many influences, depending upon the various uses to which it may be put. Unoccupied land is likely to be used first for grazing or farming, then, as population increases, for residences, and later for business purposes, manufacturing or trade, or both. So far as the value of surrounding property is concerned that building is most desirable which best fulfills the general purpose for which land in the vicinity is used—a good farm-house in the country, or a fine residence on an improved street, or a large store in the business section.

A building, no matter what its use, which is discordant in any way lessens the desirability of contiguous property and so detracts from its value, as a store in a residence street. Generally speaking, any large institution of which the inmates are not united by association or community of interest with the people of a closely settled neighborhood in which it is placed is a detriment to property about it. Beauty of buildings or of grounds may decrease this disadvantage in spite of the lack of connection between it and its environment.

Suburban or country property is not so much affected by such an institution because initial values are less, and may be so low that its presence will cause values to rise. An increase in population, other things being equal, helps values, and the institution may be relatively large enough to have this effect. Such improvement may be limited and should be compared with what might have taken place or the extent to which it might hereafter be likely to go if there had been no such institution.

Hospitals of any kind would be objectionable to some people, partly because of the reason given above and partly because the proximity of suffering or sickness is in itself distasteful. A detention hospital raises this opposition to the superlative degree, and prospective neighbors have been known to fight off such a necessary refuge for the unfortunates requiring treatment somewhere with all the fervor of a holy war.

Two years and a half ago I asked Dr. Biggs whether there would be any danger to residents in the vicinity if a detention hospital for smallpox and such diseases was located in the center of a piece of ground containing more than six acres in the suburbs of a western city. "Not a particle," he answered. "There has never been a case of infection from ours in New York, though it is located next to the most crowded portion of the city; but unless human nature is different there you will find the most vigorous opposition to it." Human nature instantly revealed its similarity, and the pest-house, as it is called, is still no nearer an abiding place than the wandering Jew, or the tramp who is told by the policeman to "move on." Each councilman is entirely willing to have it in any one of the other six wards, but as soon as a location in his own is offered he and his constituents raise a greater tumult than the Chinese when they beat their tom-toms and other noisy instruments to ward off an eclipse. So far the vociferation, coupled in one instance with a threat to burn the building, has been as effective in frightening away the authorities as that of the Chinese in making the dragon disgorge the sun, for no location has been held much longer than the duration of a solar eclipse, and the sky is now entirely clear.

This leads us to the second element in the problem of the effect of the institution on the value of surrounding property—the knowledge that it is for tuberculous patients. In itself this must be objectionable, for tuberculosis is now known to be communicable rather than hereditary, and those who know no more are likely to fear and avoid it. Fuller knowledge dispels the fear and shows that under the training of a well-conducted sanatorium there is less danger of infection from a hundred patients than from two uninstructed consumptives going at will about the streets and disposing of their sputum in the way most convenient for themselves.[1] We cannot overcome all the disadvantages of an institution, as such, but we can and should be sure that it is not in the slightest degree a menace to the health of those who live near it. This danger being therefore imaginary rather than real, there remains the interference with the serenity of people in the neighborhood who come in contact with men and women whose appearance often discloses the struggle for life they are making, in which some are not winning.

In order to learn the facts concerning sanatoria already established an inquiry was addressed to seventy-seven of the largest of such institutions throughout the United States and in Canada. Besides the name,

[1] Sanatoria for Consumptives, Waters, p. 29.

location and date of establishment thirteen questions were asked as to the character of the sanatorium and its buildings, the effect it has had on the community and on surrounding property and the attitude of people in the vicinity towards it. Replies more or less complete were received from fifty-nine of these, located in twenty states and territories, of which thirteen are in New York and two in Canada. Some general groupings from these returns may be of interest.

As to location there are:

In cities	18
In suburbs, smaller towns or settled country	18
Isolated or in thinly inhabited country	23

The capacity of the fifty-nine institutions runs from 12 at Lake Nebagamon, Wis., to 350 each at the Massachusetts State Sanatorium and St. Joseph's in New York, as follows:

Capacity 50 or under	24
Capacity over 50 to 100	18
Capacity over 100	15
Capacity not stated	2

And as to the class of patients taken, 28 are for those who can pay, 19 for those who cannot, and 12 for both. As to the kind of cases, 34 are for incipient or probably curable cases, 23 for those in any stage and 2 for advanced or presumably hopeless cases only.

The time during which they have been established, important as showing the period during which any influence on the neighborhood has been exerted, ranges from the State Sanatorium in Wisconsin, just being erected, to the Lincoln Hospital in New York City, started sixty-seven years ago. Several others were originally for other cases, and an approximately close division would be:

1 year or less	4
2 to 4 years inclusive	26
5 to 10 years inclusive	18
Over 10 years	11

The kind of building would also make a difference about the effect on adjacent territory, and a classification of these must be somewhat indefinite. As nearly as may be gathered from the data obtainable we may distinguish them as:

Very good	11
Good	34
Fair	77
Poor	6
Not described	1

Another principal element in the problem is the quantity of land; for an institution with ample grounds may be more or less self-contained, the patients mingling little with the outside world, while the limitations of a small lot may make walks about the neighborhood for exercise unavoidable. Aside from five on city lots or blocks, the quantity runs up to 700 acres at the State Sanatorium of Minnesota, and there are those of

20 acres and under	7
Over 20 up to 100 acres	15
Over 100 up to 200 acres	6
Over 200 up to 500 acres	6
Over 500 acres	4
Not stated	16

Although the question as to any change in the value of the land owned by the institution, measured either by its valuation for taxation when acquired and now, or in other ways, bears directly on the subject and was plainly asked, it was not answered in thirty of the responses, and four replied that the land was not valued for taxation. The other twenty-five reported as follows:

	Established.	Located in		
		City.	Country.	Isolated.
3 Increased	2, 4 and 14 years	2	1	
3 Much increased	3, 21 " 67 "	1		2
10 Doubled in value or more	2 to 42 years	1	5	4
9 No change			2	7

In no case is it stated that the land on which the institution is situated has decreased in value, and as its worth depends largely upon the value of surrounding property there is nothing in this to indicate an unfavorable effect of the sanatorium.

Coming directly to the difference in the character or value of adjacent property since the founding of the sanatorium, an answer more or less definite has been obtained as to each, and divided into four classes with other features noticed they are:

	Established.	City.	County.	Isolated.	Free.	Paying.	Both.	All Cases.	Early.	Late.	Large (150 A+)	Smaller.	Not Stated.
21 No change in character or value	1 to 30 yrs.	6	3	12	8	8	5	10	11		4	6	11
24 No change in character, increased in value	2 " 67 "	8	10	6	7	13	4	8	15	1	7	15	2
10 Improved in character, increased in value	2 " 24 "	2	5	3	1	7	2	3	7		3	5	2
4 Nearby property injured or not improved	3 " 42 "	2		2	3	1		1	2	1		3	1

In 58 per cent. of the instances, therefore, there has been an increase in the value of the land adjacent, accompanied in 17 per cent. by a change for the better in the purposes for which it is used; in 35 per cent. there has been no change, and in 7 per cent. a more or less marked depreciation in land immediately adjoining is admitted. In one instance this effect is for a distance of 400 to 800 feet, in another up to 1,500, while in the other two cases the opinion is given that the presence of the sanatorium has prevented or would prevent sales.

Connected with the foregoing both as cause and effect is the attitude of the community toward the institution. In one case this is not stated, in 37 it is said that there has been no opposition at any time, in 2 that there was once vigorous opposition, in 5 that there is some objection still and in 14 that there was once opposition, which has since disappeared.

Related also is the general effect on the community, which takes in other aspects than that of commercial values. This is stated as follows:

Helpful, and in some cases educational also	21
Not unfavorable	6
Increased population	1
Educational	9
Detrimental to sale of land	4
No effect	18

The circumstances about these institutions are so complicated that it is difficult to determine how far any change in surrounding property is due to the sanatorium, or what features in this surrounding property or in the institution have accounted for it. The average length of time for which the 10 sanatoria about which there has been a change in

character as well as an increase in value have been established is 12 years and of those in which the increase has not been accompanied by any change, excluding Lincoln Hospital in New York City, established 67 years ago for other purposes, 6 years. The percentage of increase in the six cases of the former where an estimate is given ranges from 15 per cent. to 300 per cent., and the average rate per annum is 6.7 per cent., while the average length of time during which the 6 have been established is 13.7 years. In the seven cases of the latter group in which a definite statement as to percentage of increase in value is made it runs from 15 per cent. to 100 per cent., averaging 16.6 per cent. per annum, and the average length of time the seven have been established is 4.3 years. Combining the two, the average rate of increase per annum for the whole 13 is 12 per cent. and the average number of years established 8.6. Although two of the institutions showing the next to the largest rate of increase are located in a rapidly developing section of California, where the improvement is largely due to other causes, and although part of the increase in other cases, which are for the most part in places less affected by other circumstances, may be due to the general advance in prices of property constantly taking place throughout our growing country, these figures seem to indicate that in many cases a sanatorium has a beneficial effect on property values except perhaps of that in immediate contact. It is unfortunate that the number of instances is not larger, as percentages drawn from so few are of less value, but of the thirteen 38 per cent. were in the city, 46 per cent. in the country and 16 per cent. isolated; while about half were for paying patients and one-quarter each for free or for both. There were 38 per cent. on tracts of land of 150 acres or more and 54 per cent. on smaller tracts or lots, with one not stated.

The above opinions as to the effect on the neighborhood came from those connected with the sanatorium, and to that extent may be unduly favorable. Some effort was made to get opinions from local authorities, to which reference will hereafter be made, which in five cases out of the thirteen confirmed or did not contradict the opinion given, and in one other declared that the growth had not been influenced by the institution.

How far the increase in values noted is but part of the general rise throughout the country it is difficult to determine for want of a proper standard. The average value per acre of farm land in the United States was $22.72 in 1880, $25.81 in 1890 and $24.39 in 1900, a net in-

crease of 7 per cent. in twenty years, or .35 per cent. per annum,[1] which in no way compares with the rate given for that about the sanatoria of which we know; but as an area of nearly 60 per cent. of new land had been added during that time the nearly stationary value may have been due to the proportion of this and not to a lack of increase in the value of land listed in 1880. It is probable, also, that agricultural conditions, which might not affect the property by which many sanatoria are surrounded, may have kept farm land from advancing as residence property did, or even put it back during the second decade.

The national wealth increased from forty-two billions in 1880 to ninety-four billions in 1900, which is 121 per cent. or 6 per cent. per annum, which is still only half the average rate for the property adjacent to the thirteen sanatoria; and if we take the national wealth per capita, which is perhaps a fairer basis, the increase from $850.20 in 1880 to $1,235.86 in 1900[2] is 45 per cent. or only 2.25 per cent. per annum. It may be that the rate for farm land and for national wealth during the last six years covering more nearly a part of the average period during which these sanatoria have been in existence has been more rapid, but it could hardly have increased enough to greatly affect the conclusion above drawn.

Several instances showing very large percentages of increase, which bring up the average materially, cover an existence of from three to five or six years only, and so far as the change is due to the starting of the institution it cannot be expected to continue. The initial value of the land, also, has an important bearing on the percentage. It is possible that failure to make any approximate statement as to the amount of increase in any case indicates that it is not so large, and that the average where not stated is much less; and information in some of the other twenty places tends to confirm this idea. In two small places, where the sanatoria have been established nine years and have been the only apparent reason for the growth, there has been an increase in the amount of taxable property listed of 36 per cent. in one case and 44 per cent. in the other, or an increase of 4 per cent. and 5 per cent. per annum.

Some reference to individual instances may be instructive. The Cullis Consumptives' Home, for advanced cases, at New Dorchester, a

[1] Statesman's Year Book, 1902, p. 1303.
[2] Statistical Abstract, 1905, p. 534.

part of Boston, Massachusetts, was removed to its present location in 1871. There was no opposition then, but there was considerable when a permit was asked for the new building in 1896, due, probably, to the discovery meantime that the disease is communicable. A careful examination showed that there was no danger and proved that the death rate from tuberculosis in that ward was the lowest in the city. Further experience has made warm friends of nearly all those who were in opposition eight years ago. The assessed value of surrounding land is about five times as great as it was in 1870.

The Brooklyn Home for Consumptives was established in 1881 and has been removed to another location since. There has been no objection to it in either place. No employee, though some of them have served eighteen years, has ever contracted the disease. The institution is well kept and one of the board of health officers has expressed the wish "that there were a hundred more like it."

St. Joseph's Hospital for Consumptives, in New York, started in 1882, has apparently had no unfavorable effect upon values, perhaps because it occupies an entire block and is surrounded by a garden which gives light and air to the apartment houses which have since been built up around it. There has never been any opposition to it, and values of adjacent property have increased from one-fourth to one-half. These three are fair examples of the influence of a well-conducted sanatorium in the city.

The Adirondack Cottage Sanatorium is of course the earliest instance of one in an isolated locality, and its wonderful success has added greatly to values in the neighborhood by the large increase in population with the attendant expansion, or rather, creation, of business which these have brought. It is difficult to measure the increase in the twenty-one years since its establishment, but property which formerly sold for $100 per acre now brings five cents a square foot, which means a more than twenty-fold increase in its value. The sanatorium has certainly done a great deal for the village of Saranac Lake, which amounted to little or nothing before its establishment and is now a prosperous town.

Since the Winyah Sanatorium at Asheville, N. C., was founded in 1886, the value of surrounding property has increased probably threefold. In this case the institution, at first at least, aided, and by its demands assisted in securing municipal improvements and better hygienic conditions. The tract of land on which the sanatorium is sit-

uated is large and only within the last year has it been taken within the corporate limits of the city.

The mayor of Asheville writes that the location of a tuberculosis sanatorium has a very decided tendency to decrease the value of property in its immediate vicinity. The city has passed an ordinance forbidding the establishment of such an institution without first having obtained a license, and reserves the right to determine whether or not any location proposed is proper.

It is certainly better that the health seekers who visit that region should be properly instructed and taken care of in such institutions than that they should be permitted to live in boarding-houses and go about without observing any precautions, as they were doing something more than twenty years ago before it was known that such precautions were necessary. The condition of the community in this respect was no doubt worse than it could be made by the presence of any reasonable number of sanatoria.

As to the Sharon Sanatorium at Sharon, Massachusetts, established fifteen years ago, the facts show that while there has been little change in the character of surrounding property it has greatly increased in value. Real estate agents say that the presence of a santorium has been most valuable in attracting attention to Sharon as a healthy place; and the erection of houses in the vicinity, and the prices at which various pieces of land have been sold, indicate that values have greatly increased, even near the sanatorium, and that they are now three times what they were before the institution was located there.

These statements are confirmed by three leading residents of Sharon in letters replying to a recent inquiry by Dr. Farrand. They agree in saying that values have increased; that while some few timid people may have been kept away by prejudice, the sanatorium has helped the growth of the town; that it has not kept away any educational institutions, and has not increased tuberculosis among the natives or affected the general health unfavorably.

The Loomis Sanatorium, at Liberty, N. Y., has been in existence ten years, during which time the selling price of surrounding property has increased at least one-third. This is no doubt due largely to the effect of the sanatorium, which has not only attracted patients but also residents who come for the whole or part of the year to take advantage of the excellent climate. Dr. King has recently secured statements from the railway agent, the express agent, the health officer, the super-

visor, four doctors who have been in practice from seven years to forty years, a real estate agent and a number of the leading business men, which show that the general business of the town has very greatly increased; that the railroad passenger business has increased about 20 per cent. yearly for the last five years; that the express business has increased 40 per cent. in seven years; that according to the last enumeration the population of Liberty and the surrounding towns has increased 14 per cent., or 2465 persons, in the last five years, while the increase in the other towns of the county has been only 124 persons; that real estate values as well have improved; that the roads are better; and that there has been no increase whatever in the prevalence of tuberculosis among the natives. This leads to the conclusion that the presence of a well conducted sanatorium does not cause any material depreciation in real estate values in such a community and that the small town near which it is located will be benefited by it. From this there is no dissenting opinion among the citizens consulted.

The effect of the large state sanatorium at Rutland, Massachusetts, established eight years ago, was spoken of in the annual report in October, 1904. The facts show that the town has benefited largely in a material way and has not suffered at all in health. The total valuation of the town on the assessor's books for 1904 was $704,183, an increase of 36 per cent. in nine years, or 4 per cent. per annum. The population had increased and the requirements of the sanatorium had led to the introduction of an excellent water supply which without the sanatorium would have been impossible. Public health has not suffered. .

Replies to a similar inquiry by Dr. Farrand from the chairman of the selectmen of the town, who is a large property owner, and from one of the leading physicians, agree in stating that the sanatorium has increased the value of land; that it has attracted rather than repelled desirable residents; that it has not tended to keep away educational or similar institutions, and that it has improved the health of the community by its educational influence.

An opinion contrary to this in some respects is given by another taxpayer who declares that the romantic and historic old town, easy of access and formerly having good society and many visitors, has been rendered by the sanatorium unbearable except to keepers of private sanatoria, and that had it not been for the institution there would have been fine hotels, educational institutions and other improvements by

this time. He states that his residence, three miles distant from the sanatorium, is for sale at one-third less than he would have asked before its establishment.

While there may be some foundation for this opinion, it is evidently influenced largely by personal feeling, and what improvement the town might have shown in the absence of the sanatorium is of course a matter of conjecture. It is certain that the improvement which has taken place is substantial.

At Gravenhurst, Ontario, there are two institutions, one for paying patients established in 1897, and the other the free hospital in 1903. The facts given in detail in a report from each show that when the first was located there was no objection, but when it was proposed to start the second some opposition on account of a fear of the disease was developed. This has now almost entirely disappeared, as no case of consumption in the district can be traced to the presence of the sanatorium. The testimony of the mayor and the editor of the local paper is that there is more business done in Gravenhurst than ever before and the town never was so prosperous. The assessment for taxation in the town has increased 44 per cent. in nine years, or practically 5 per cent. per annum, and the population 26 per cent. during the same period.

Another instance of the benefit of a large and well-conducted sanatorium to a small town is that of the Montefiore Country Sanatorium at Bedford, N. Y., also established nine years ago. The taxable valuation of the sanatorium land has doubled since it was acquired and while the surrounding country, which is mainly devoted to farming, has not been altered, values have increased from 40 to 60 per cent. on account of a general advance in real estate in that section. The slight opposition at the beginning, due to a fear of the disease, has disappeared and there is now a general feeling of good-will on account of the recognized benefit from the institution.

The old lumber town of White Haven, Pa., which had no apparent prospect of ever building up again when the sanatorium was started there in some old farm buildings, five years ago, is now quite lively and property has increased in value. The success of the institution has brought other sanatoria, the commercial benefits of which have done away with what opposition there was at the beginning. The experience of the Boulder Lodge Sanatorium at Fort Dodge, Iowa, during the same length of time shows that the institution has not

checked a very great increase in real estate values, due, however, to other conditions and not to the institution; and that the beautiful grounds are an attraction to those who visit the place.

The property owned by the Mount St. Rose Sanatorium, in the outskirts of St. Louis, has increased in value about 50 per cent. since the sanatorium was started four years ago. It cannot be said that this increase is due to the sanatorium, but the beautiful grounds and the fine buildings have certainly aided rather than hindered the advance.

An example in a new country is the Pottenger Sanatorium in Monrovia, Cal., established three years ago. The character of the surrounding land has improved even within this time and real estate values have increased on account of the establishment of an electric line and in part on account of the demand for real estate caused by the sanatorium, which is considered by some to have been a great blessing to the town, although there is still some opposition on the part of others and an effort is now being made to secure the passage of an ordinance which will make it impossible for anyone else to place such an institution within the corporate limits.

Another typical institution is the South Mountain Camp Sanatorium in Franklin County, Pa., which is isolated and without attractive buildings. The value of property has about doubled in the three years and the presence of patients has caused a demand for produce which the country people appreciate. Another case in which the institution has been of benefit to a farming community, with some increase in value, is that of the Gaylord Farm Sanatorium which has been in existence but two years. It is near Wallingford, Conn., a manufacturing town of about 10,000 inhabitants. There was considerable opposition by the people of the town to its establishment but this has largely disappeared as they have come to know more about it. It has increased business, brought visitors and apparently caused some increase in real estate values.

In addition to the opposition noted in the previous instance it is stated in another case that while the institution has had no effect on surrounding values it is probable that the land could not be sold so readily if put on the market, as there is some prejudice in the minds of the laity in regard to such institutions; in another that all are proud of the institution though "everyone is scared of consumption"; in another that there is no question that the existence of the institution has prevented the erection of residences immediately adjoining it; in

another, recently established, that there was very decided opposition in the whole community which has changed to active support and there is no opposition now; in another, in a city, that there was no opposition at first but when tents were put up in the grounds objection was made for aesthetic reasons; and in another city institution that there was strenuous opposition on the part of residents, which seems to have been unreasoning or due to personal prejudice, as they were not as a rule owners of property.

A study of these various instances indicates that twenty years ago there was indifference to the establishment in the neighborhood of an institution for the treatment of tuberculosis. A partial knowledge of the nature of the disease has produced a hyper-sensitiveness in regard to it and developed opposition which a fuller experience removes in time. In some cases this opposition is due to prejudice rather than to any feeling of danger or the possibility of any considerable decrease in the commercial value of property. This was apparently true in the circumstances attending the proposed establishment of a municipal sanatorium for New York City, in April, 1903. Following the decision to erect one a desirable tract of ninety acres in Orange County was offered to the city, rent free, and definite steps for the erection of buildings on it were about to be taken; but as it is related that, before Buddha first went out from the palace where no mention had been made of "death or age, sorrow, or pain or sickness," the king commanded that there be seen "none that is sick, or stricken deep in years," and that "no feeble folk go forth," so the owner of a vast estate near the site of the proposed sanatorium, not being filled by the pity taught by Buddha's later life, also desired to see no feeble folk with hollow cheeks along the ways where he passed in his automobile, and having influence with the government of the state succeeded soon in having the Goodsell-Bedell bill passed, in spite of the protest of the New York Academy of Medicine, and of the declaration of the commissioner of public charities that it "would result for years to come in more sickness, destitution, suffering and death among the tenement-house population in New York than it was possible to calculate." This law compels the county supervisors and the town board each to adopt a permissive resolution, in addition to the consent already required from the state and local boards of health, before any municipal sanatorium for tuberculosis can be established anywhere in the state. Since it was made impossible to secure such consent for this the site had to be given up. Other attempts to obtain

one also failed and two years later the health department had to abandon a large and satisfactory tract of land offered it in Sullivan County because the town board refused to permit its purchase for the purpose; but in the summer of 1905 a fine location with more than one thousand acres at Otisville in Orange County, on the Erie road, seventy-six miles from New York, was purchased, on which buildings nearly ready for patients have since been provided. Even then the Erie railroad agent, with the assistance of some people in the vicinity, did what he could to prevent the establishment of the sanatorium in the place.

A proposal several months since by private parties to start a sanatorium on Long Island met with opposition, which, so far as I know, stopped it. Last year General Sternberg, for the Washington Sanatorium Association, had an option on a very desirable property in Rockville, Md., about twenty miles out of Washington, but before the transaction could be closed the town passed an ordinance prohibiting the location of any institution for tuberculosis within the city limits, making it necessary to look elsewhere. When a farm house with six acres of land was bought near Washington Grove the camp-meeting association of that place had a spasm of fear, and demanded that the sanatorium be called by some other name, which accounts for its being known as Starmont, after General Sternberg.

In the search for the best location for the State Sanatorium in Ohio one hundred and four sites were offered besides the one of three hundred and fifty-seven acres near Mt. Vernon finally chosen, and in only one instance did opposition before the commission develop; but there is evidence of latent objection in some cases which would perhaps have become active if the location had been more seriously considered, and there was a very little in Mt. Vernon after the site was chosen, which was removed.

No unfavorable effect on adjacent property has resulted from the clinic for pulmonary diseases in New York City, but a similar dispensary, which was being started by the Health Department a year ago in Brooklyn, was stopped by an injunction granted by Judge Marean of the Supreme Court, who declared in his opinion that the institution would be a " crying nuisance," and that the complainants, among whom was a doctor, were right in swearing that its establishment would cause them irreparable damage. A similar prejudice hinders the location of one in Columbus, Ohio, and of a day camp outside the city.

The mayor of Denver writes that the hospitals for consumptives in that city are so sanitary and kept so chemically clean that they are little if any more objectionable than any other kind of hospital; but the head of the health department of another large city, while declaring that there is no reason why institutions for tuberculosis should injure surrounding property, says: "I think, as a rule, people are opposed to such institutions and that some would sell at a sacrifice were such an enterprise inaugurated in their neighborhood."

Lifting his eyes to the painting of the Last Supper on the refectory wall of an old monastery in Italy one of the brothers said to a traveler who was studying it: "When I look at the figures in that picture and think of the changes which have taken place in the centuries since the artist placed them there, of the men who have sat at this table who are now gone and of how we too shall soon disappear, it sometimes seems to me that they are the substance, and we are the shadows."

So in the establishment of a sanatorium it sometimes seems that the real obstacle is the prejudice, the groundless fear, the unreasonable and unreasoning opposition of the people, in comparison with which the raising of funds, the removal of rocks and the construction of buildings are trifles. Where such antagonism exists, whether just or not, it demands consideration, and any needless interference with values should be avoided. Experience has proved that there is absolutely no danger from a well-conducted sanatorium, and that there is no valid reason for fear in regard to it. Too much emphasis cannot be laid upon this point; but it is easier to explain this to the few people in the suburbs or in the country than to the many in a more thickly populated section. Whatever damage there is will be less in the case of property not already very valuable than in that of residential streets or fine suburban homes.

It is quite clear that in the wide choice which the present knowledge of the necessary treatment affords some place within the region in which it is needed may be found for almost every sanatorium yet to be erected where a wise policy may benefit the community and make friends, as has been done in so many of the cases cited. The educational influence of each of these institutions, exerted through its patients, extends beyond its own neighborhood and by increasing the knowledge of the nature of tuberculosis lessens the fear of it when proper care against infection is taken, as it is in all well conducted sanatoria. The more completely this knowledge prevails the sooner

will those in need of sanatoria seek their shelter, the shorter will be their stay, and the sooner will any unfavorable effect on surrounding property by reason of the purpose to which such institutions are devoted disappear.

DISCUSSION ON MR. BALDWIN'S PAPER

Mr. Homer Folks, New York: The chairman has alluded briefly to some New York experiences, but in order that we may appreciate perhaps more fully how really serious this problem is I should like to recount very briefly the experience we have had in the past ten years.

The opening of our state hospital for consumptives was delayed something over two years by the opposition of the residents of the locality in which it was proposed to build it, and whatever benefits we have derived from it we were thus deprived of for rather more than two years. In regard to our city sanatorium we were delayed for more than three years by the opposition of residents in the locality in which it was proposed to place the institution. We were authorized by the law of 1900 to establish a sanatarium outside of New York. In 1902 steps were taken to select a site; and now, in 1906, we have secured a site which we trust will be available in the near future.

The origin of the Goodsell-Bedell-Odell bill requires a little explanation in justice to the gentlemen who secured the passage of the legislation. There is reason to believe that the offer of the use of a choice site, that was made to the city in 1902, was not made with an eye single to philanthropy. The sale of this piece of property to a wealthy gentleman, owner of a fine estate adjoining on which he had spent large sums, had been attempted, and failing to secure what it was thought to be worth, it is suggested that the owner thought that by taking the other course a larger price for the property might be secured. The result, however, was the passage of the bill which delayed our sanatorium three years and which has in some cases prevented the establishment of other sanatoria in other parts of the state.

The chairman did not refer to our experience in establishing a tuberculosis dispensary in the borough of Brooklyn. The health department of the city endeavored to locate the first and only tuberculosis dispensary in the borough of Brooklyn. It selected a building and the residents of the neighborhood protested vigorously and finally brought a suit to enjoin the health department from establishing a dispensary at

this place. Although those who were interested in the establishment of the dispensary felt no special concern over the suit, feeling sure that no court of high degree would decide that such a dispensary would be dangerous to the health of the residents, they were disappointed. Excellent medical authorities submitted affidavits in evidence showing that such a dispensary would be of absolutely no danger to the community, but in what I think I may call a most extraordinary decision, it was held that the evidence of the physicians was not at all conclusive and that there could be no doubt that such a dispensary would be very dangerous indeed to the health of the neighborhood, and the department was enjoined. That still stands and there is no dispensary there to-day.

The Charities Department recently decided to establish a hospital for consumptives on Staten Island. It acquired the property before its purpose became generally known and it was not possible to set the law in motion to prevent its acquisition, but a bill was introduced in the legislature to require the consent of the local authorities before the hospital would be established. The bill did not pass and perhaps this fourth and latest effort will be carried through without serious drawbacks as far as the local clamor is concerned.

The manner in which we have been held up is very significant and I think it indicates that the prejudice is deep-seated, widespread and persistent, and it behooves us to be as wise as possible and as careful as possible in carrying our movement forward to arouse that spirit as little as may be. A matter of the greatest value is the work the chairman has inaugurated, that is, collecting as exact data as can be had concerning the effects of the establishment of sanatoria upon property values. Of course we all understand that there is no bad effect upon the health of the people, but the fear that there may be a bad effect upon the health of the people has its effect upon the value of the surrounding property. I should like to see this data collected by the chairman published in convenient form for distribution, with such additional facts as may be had from time to time.

The question is a very different one as it relates to rural, suburban or urban districts. In the country it may even be of value to have a sanatorium established. I am disposed to think, however, that in a so-called high-class residential suburban district the effect on property values may be harmful, for a time at least. Personally I do not see any reason why the theory of compensation for damages should not

apply to the proposition. If we build an elevated railroad a person has a right to a claim for damages if his property is depreciated in value. I see no reason for not applying that to this situation. While the idea is in the main based upon prejudice, so long as it exists it is a tangible thing to the property owners.

It seems to me that we should take a lesson from our experiences in the past and endeavor to select localities for such institutions in which, other things being equal, we are least likely to meet such serious opposition. There are plenty of desirable localities for sanatoria and dispensaries. I suspect that we should not have had to wait two years for our hospitals if we had not gone so near the home of one of the most influential citizens of the state. If we had decided at first to come to the place finally selected probably we could have gone to work without delay. And, with regard to the city sanatorium, if we had set out at first to secure the property that was finally taken and had not undertaken to accept a gift (the offer of which should always be looked into carefully) and to get for nothing a site which was very near the residence of a wealthy man, we might have had our sanatorium two or three years ago. If in our proposed location for a dispensary in Brooklyn we had gone a little farther from the choice residential section where the editors of the Brooklyn papers and the judges of the courts live, we might have succeeded earlier.

It seems to me the most important factor to be borne in mind is not needlessly to arouse a prejudice, because it is the most difficult thing in the world to deal with, and the more unreasonable the prejudice the more impossible it is to overcome it.

Dr. John H. Lowman, Cleveland: The paper of Mr. Baldwin is a most valuable and timely one and should immediately be accessible to every one. I wish, however, to make more emphatic what was said on the danger of infection in sanatoria. A well conducted sanatorium is almost absolutely free from danger and is in no degree a menace to the public.

Turban of Davos states that there has never been but one case of tuberculosis that has developed among his employes—that of a maid who washed the linen of the patients. Although 3,000 patients have been treated in his institution, this is the only case in which there has been any suspicion of contagion. Joel of Goerbersdorf has failed to find a single case of infection in the institutions there, although 13,000 patients have been treated in them.

Cultures have been repeatedly made from the walls of sanatoria in the wards and rooms where patients stay, and in no case have the bacilli been found. It would seem that a sanatorium is the place most free from dangers of infection.

According to Dr. Coate's (Manchester) experiments 60 per cent. of the houses in which consumptives live are infected. Thus it is the uninformed patient who is a danger to the community and not the supervised patient in a sanatorium. Were these facts known and understood by the public the fear of contagion, which is the origin of the opposition to the sanatorium, would disappear and the present difficulties would cease.

Dr. John P. C. Foster, New Haven: After what I have heard here I begin to think that I have been a very fortunate man. Some of you may know that I have not been strongly in favor of state sanatoria, but rather in favor of private sanatoria with state aid. In our state I started out with that idea. Three or four of us got together and founded a state sanatorium that we could own. We went out and bought a farm and went to work. No opposition was ever raised to it. It is interesting to note that within six months, while the cellars were being dug, the adjoining place was bought by a wealthy gentleman for the purpose of building a summer residence. A great sanatorium, such as a large state must have, will bring out many people in opposition. I hope to live to see a sanatorium, such as the one I am connected with, in every county in Connecticut. I do not think four or five hundred should be brought into one place to attract attention.

We doctors have done an immense injury to the whole tuberculosis cause. We are responsible for this unreasoning scare that has taken hold of the people. Every little society in every little town has a tuberculosis committee and there is a mass of literature flooded upon the country that has scared every one. The important thing now is to undo the mischief that has been brought about in this way. Leaflets should be gotten up and distributed to explain the truth about the problem. Our board has recently adopted this plan and the original paper that we copied in a measure was the one gotten out by Dr. Fulton, Baltimore, which was a splendid piece of work. As to the question of sanatoria for the pauper element, I think all that is necessary is to have decent wards built immediately adjoining the hospitals, and there would be no objection then to meet.

Mr. H. Wirt Steele, Baltimore: I do not think we are any better in

Maryland than you in other states, but there is no phthisiophobia there that I have been able to discover. There are a number of people here from the West who have just begun to consider the question and I think it might be well to sound a note of warning about beginning at the wrong end. If you start in by talking sanatoria, or attempting to build them, before the ground work has been laid for the movement the scare is bound to come. In Maryland we spent five years in an educational campaign before the question of sanatoria was talked about, five years in slow, painstaking public education. The pamphlet of Dr. Fulton's, referred to by the last speaker, has been very generously used throughout the state. It is a simple thing, to the point, and contains no large black type. One point of interest concerning it is that it does not bear the label of the printer's union and was refused at several meetings of union people lately.

When the last legislature created a state sanatorium there was but one county that would have objected to having it and that was because some of the Washington people had come there and tried to establish a sanatorium before this educational work had been done. Three counties have already organized efforts to secure the sanatorium for their county seats.

Dr Livingston Farrand, New York: I agree that phthisiophobia is one of the most important subjects we have to consider, but if I interpret the signs of the time correctly it is not the fear of infection at all that prevents the establishment of sanatoria, but as Mr. Folks has shown, the fear that institutions of this kind will lower property values in their neighborhood. Our chief trouble is not in the establishment of sanatoria in the cities, but their establishment in the country and in towns of small size. It was the apparent epidemic throughout the East of objection on the part of surrounding property holders to the establishment of these institutions which created one of the real demands for the paper read by the chairman.

TUBERCULOSIS NOSTRUMS

By Samuel Hopkins Adams

New York

Tuberculosis is the vital error of the medical profession. One cannot read the advertising columns of the newspapers without having this conviction forced upon him. Therein he will daily find the proclamation of a great army of professional philanthropists who expend an immense amount of money proving that they are the true saviours of the race and clamoring for opportunity to extend their field of altruism and wipe out the the Great White Plague,—at a modest profit to themselves. Through a careful consideration of the daily advertising columns, I am compelled to the belief that almost anybody can cure consumption except the physician in good and regular standing. Somehow or other, he has missed the blessed secret discovered by a backwoods station agent in Canada, and embodied in Dr. William's Pink Pills for Pale People (which, as the advertisement frankly states, cure tuberculosis of the intestines, as well as humpback, cold feet, and loss of memory); the secret which an ex-piano manufacturer in Toronto has thought out in toilful nights and given to a waiting world in the form of Liquozone, that germicidal combination of such harmless and innocent drugs as sulphuric and sulphurous acids; the secret which a California hotel keeper, dispensing morphine in disguise as Dr. Boschee's German Syrup, has turned to excellent account; the secret which an itinerant quack has coined into millions under the trade name of Pe-ru-na, and a thrifty whiskey-vendor has employed wherewith to dispose of his low-grade stock in Duffy's Malt Whiskey; which, in short, is no secret at all but an open book to half the quacks in the profitable business of selling secret poisons. Every man-Jack of them knows how to cure consumption in whatever form, and knows that he is the only one who does know. At least, that is what the daily papers tell us. You and I, perhaps, do not place implicit faith in everything we read—particularly in the paid advertising department.

But thousands do, and therein lies the master-power of the great American fraud.

It is hardly necessary to say to a gathering such as this that any nostrum which claims to cure tuberculosis is a detriment to the patient, since, if it does no worse, it at least diverts him, by falsely inspired hopes, from the careful regimen of life wherein lies his best chance of recovery. Tuberculosis nostrums, therefore, may be divided into the positively harmful and the negatively harmful classes. In the first class I should put all those containing opium, hasheesh, chloroform and any considerable quantity of alcohol. Every physician whose work takes him into the slums well knows the typical history of the consumptive working man who puts his faith in this class of nostrums. Stimulated by the alcohol, or lulled by the morphine, into a factitious hopefulness, or security, he continues his unchanged habits of life until the final break-down comes with appalling swiftness. To those of the medical profession I leave it to say how swiftly incipient tuberculosis becomes galloping consumption under the influence of these drugs.

I will venture the statement that every vendor of the alcohol and opium class of "consumption cures" is a self-confessed swindler. Put them to the question direct; ask them what they really think of their "cures," and they will squirm and dodge. Dr. Hartman, owner of Peruna, will not pretend—as I know from personal experience—that his concoction of raw alcohol and inert drugs, with a recent addition of cathartics to evade the internal revenue tax, is a specific for consumption. A. C. Meyer & Co., of Baltimore, who make the morphine dose known as Dr. Bull's Cough Syrup, write me privately, "We do not claim that Dr. Bull's Cough Syrup will cure an established case of consumption. If you have gotten that impression you most likely have misunderstood what we claim." It may be so; to err is human, yet it is difficult to find any basis for misunderstanding in the specific statement of Dr. Bull's advertising that "there is *no* case of asthma, bronchitis, *or consumption,* that cannot be cured speedily by the proper use of Dr. Bull's Cough Syrup." Similarly, Mr. Green, owner of "Boschee's German Syrup," informs me by letter, modestly enough, that "some cases of consumption are beyond cure." On Mr. Green's sample bottle I find that his so-called remedy is a "certain cure for all diseases of the throat and lungs." There is a general impression abroad that consumption is quite commonly a disease of the lungs and occasionally of the throat; but Mr. Green evidently thinks otherwise.

He presumably connects it with the teeth or the vermiform appendix. Otherwise his "some cases of consumption are beyond cure" and his "certain cure for all diseases of the throat and lungs" seem hardly compatible.

When I wrote to inquire on this point he was too busy running his hotels in California to enlighten me. His so-called "remedy" depends for its virtue on morphine and hydrocyanic acid. Dr. King's New Discovery for Consumption which "strikes terror to the doctors," according to its advertisements, is in this same category; its morphine is mixed with chloroform. Chloroform and prussic acid enter into the composition of Shiloh's Consumption Cure. And so on, through a long, but happily decreasing, list.

The negatively harmful roster is much greater and includes a number of so-called "ethical" preparations, supported largely by physicians. Ozomulsion, for instance, which is now part of Dr. T. A. Slocum's Consumption Cure (a combination of nostrums which promises to remedy almost every known ill), was formerly advertised to the profession, and sports an imposing array of medical testimonials. Imposing, that is, until one looks into them. Most of them on examination are found to come from the backwoods regions, where the average physician is likely to represent a low order of intelligence. Of perhaps half-a-dozen M.D.'s who wrote glowing opinions of Ozomulsion from the centers of civilization, I found one to be an obscure quack, another to be a notorious abortionist, and a third to be in the employ of the Ozomulsion Company. This last gentleman I looked up personally for the purpose of putting to him the plain question "Will Ozomulsion cure consumption?" Four times I put this query before I could dissuade him from delivering in reply extensive discourses upon the origin, history and general nature of tuberculosis, which were undoubtedly instructive and possibly valuable, but not what I was after. Finally he replied that in the early stages of the disease he believed that Ozomulsion would *sometimes* cure consumption. That is as far as I could force him, even with the blanket claim of his advertising,—"Ozomulsion Cures Consumption"—staring him in the face. There may be reputable physicians in the Ozomulsion testimonial list; if so, I do not envy them their sensations now that the nostrum to which they lent their names has come out in the open as a typical consumption cure fraud. Manola is another preparation which advertises in the medical journals. Its decidedly ungram-

matical pamphlet, which is circulated among physicians, is redolent of quackery, and while the claim of curing tuberculosis is not definitely made, the attempt to induce that belief in the mind of the reader is obvious. As to the modest reserve which is supposed to characterize ethical exploitation, I will quote one significant sentence: "It (Manola) is the *secret* power that produces healthful, vigorous metabolism." The responsibility for this sort of traffic rests with the medical profession, since it flourishes initially at least, only through the support of the physicians.

Among the open patent medicines which, in themselves not seriously harmful, delude the consumptive into giving them his money and his faith, none, I believe, dares resent the assertion that it is a fraud. At least, none in my experience has done so. Because the Dr. Pierce Medical Company of Buffalo, had, with loud outcry in the papers, threatened vengeance upon any who should attack its wares, I selected it as the object of one of my experiments. In the list of diseases which it is claimed to cure is tuberculosis, and the formidable book which it publishes contains a few testimonials to this effect. To some fifteen of these endorsers I wrote for information, getting results in nine cases. The results took the form of replies only in two instances. One of the two was positive that twenty-five bottles of the Golden Medical Discovery had cured him. A second wrote, in a system of spelling that would have delighted Andrew Carnegie's heart, that "It is the best lung Medisan I ever uset for lung trubble." The other seven letters came back marked "unclaimed," with various additional illuminating superscriptions, such as "deceased," "name not in the directory" and "no such postoffice in the state." Thereupon I wrote and published conspicuously the following sentence: "In the full appreciation of Dr. Pierce's attitude in the matter of libel, I wish to state that, in so far as its claim of curing consumption is concerned, his Golden Medical Discovery is an unqualified fraud."

Now, if I were manufacturing an article for sale and some "man with a muck-rake" described it as an unqualified fraud, I should endeavor to make him prove it—unless I thought he could prove it. I never heard from Dr. Pierce; nor has *Collier's Weekly*, which published the slanderous statement quoted above—that is, we have not heard directly. But the esteemed doctor's next issue of testimonials sagaciously omitted the addresses of the letter writers. You must take them, or leave them, on faith.

Though the market is still full of consumption frauds I believe that this particularly vicious and cruel branch of the nostrum business is on the wane. Evidence to this effect comes from the medicine men themselves. Many of them have dropped tuberculosis from the list of diseases which they promise to cure. Ascatco has done this. So, in spite of its name, has Piso's Consumption Cure, which now advertises only to cure coughs and colds. Perhaps the fact that several of the Piso factory employees have recently fallen victims to the White Plague has something to do with this. A once famous consumption cure concern in Cincinnati, the Alpha Institute (formerly Dr. Graydon) is going out of business, because, so one of the officers quite frankly informed me, there is no money left in it. "The public is getting wise on consumption," he said. "The game is played out. Something has put them onto the racket. I'm going to take up an easier line—cancer, maybe."

"The public is getting wise on consumption." There is the eventual solution of the problem. It is "getting wise" because in every principal city of the land unselfish workers are spreading abroad the essential and vital truth regarding the true nature of tuberculosis, and with that truth the doctrine of hopefulness and courage. Your association, the state associations, the city societies, and in many cases the public health officials, laboring for something better than their salaries, are letting in the light and so killing the cruel and grisly trade which sets its tax upon hopeful ignorance. Such work as is being done in the public schools of Indiana and Ohio alone, to cite two conspicuous instances, means a growing generation too wise to put its trust in the Peruna-promises of these rainbow-vendors; means, too, we may hope, a generation so aroused, when it comes to its full powers, that it will no longer permits its organs of public opinion to prostitute themselves to the noxious business. Much has been done; much remains yet to do. I would urge, if I had the power, every speaker, be he physician or layman, who is engaged in the campaign of education, to give a few words, at least, of his every address to the wastefulness, the uselessness, the harmfulness of consumption cures. He need not fire in the air. In whatsoever city or town he may be he will find his texts in the advertisements of the daily papers. Let him appeal to the very audiences to whom the nostrum makers are appealing, and in the end by his agency, and those of his co-laborers, the truth shall prevail over the falsehood.

The whole matter of nostrum control is in process of readjustment which cannot but be encouraging to those whose optimism is sturdy enough to stand a few rude shocks. Legislation looking to honest labelling of patent medicines has, for the most part, failed this year, but in certain cases failed hopefully. In New York, for instance, the bill passed the Senate, but in the Assembly it was smothered by an ingenious method which saved its opponents from going openly on the record as abettors of fraud and poison. In the very fact that they feared to face public opinion lies the strongest hope that at the next session a law will be put through. Maryland fought a good fight but the patent medicine interests which center in Baltimore, including Dr. Bull's Cough Syrup and the dangerous acetanilid concoction, Bromo Seltzer, were too strong. In Mississippi the patent medicine bill failed because it was referred to a committee misnamed the Committee on Public Health, which consists almost entirely of physicians. This committee deemed it wisest not to report the bill, which was accordingly smothered. Ohio and New Jersey also failed of obtaining legislation. Massachusetts got through a compromise measure, permitting the use of opium, morphine and other poisons to approximately the extent of their present use in patent medicines. The gilding on that particular brick seems to me a little thin in places; nevertheless, any legislation is better than none, and to have established the principle that control of nostrums is feasible is something. There is still a chance, I understand, that the Pure Food Bill will embody a patent medicine clause[1] that means something. Even where legislation has failed, one extremely important sign of awakening has been manifested. Many of the influential newspapers of the country, disregarding the pleas, the threats and the bribes of the Proprietary Association of America, have expressed themselves freely on this topic. Not only have such journals as the N. Y. *Times,* the N. Y. *Evening Post,* the Springfield *Republican,* the Rochester *Post Express,* and some smaller organs, maintained their policy of excluding harmful and fraudulent medicines from their columns and of advocating openly legislation dealing with the nostrum problem, but some of the very publications which draw an immense revenue from this class of advertising have found courage to come out openly in favor of reasonable control. The most striking instance is the N. Y. *World* which carries more medical advertising than any other paper in the country, and yet editorially comes

[1] A very excellent clause was embodied in the Pure Food Bill, as finally passed.

out flatly for the New York bill. A marked distinction between this and the Hearst papers which prostituted their editorials to the specious arguments of the nostrum vendors. The Chicago *Tribune,* the Indianapolis *News* and the Washington *Star* have also done yoeman work for the principle of honest labels on poisonous medicines. Not only this, but throughout the length and breadth of the country, the newspapers have come to realize that patent medicines are a matter of legitimate and general public interest, and have begun to print the news about them. That this requires some courage will be evident to anyone who knows the nature of the "Red Clause" whereby a patent medicine advertising contract becomes null and void if the newspaper in which it appears prints in its news or editorial columns anything inimical to the interests of that particular nostrum, or to the interests of the nostrum business in general. So to the fact that the Boston papers gave conspicuous attention to the patent medicine measure in their news columns I attribute largely such success as was achieved in Massachusetts. Editorial support is valuable, but if the papers will print the facts alone about patent medicines and remain neutral editorially, I believe that the fight will be soon won. Let in the light and a business that is founded on fraud and deception cannot long endure.

DISCUSSION ON MR. ADAMS'S PAPER

Dr. Frank Billings, Chicago: It is unfortunate that in the discussion of this very important subject we cannot have two classes of people here; first, the people who suffer, the lay people; and, second, many of the medical profession who need to be better taught.

Mr. Adams has said in his paper that the use of these nostrums is harmful to the tuberculosis patient either in a positive or a negative way. I will go farther and say, that drugs for the specific cure of tuberculosis do more harm than good, whether in the form of nostrums or as so-called ethical preparations. Now there are two classes of these medicines; first, those advertised by the so-called patent medicine people, for the use of the laity, through the public press; and, second, a vast number, larger indeed than the first, advertised to the medical profession, through the medical journals. There is no difference practically between them. For where the alleged formula is given it is frequently not true, or, the ingredients are given without the amount of each which makes it no better than a nostrum.

Now the treatment of tuberculosis by drugs, as it exists today, is the result of several things; first, that formerly we did not know what tuberculosis was and its only management was by the use of drugs, which were of several kinds; first, the preparations that were used to improve the general nutrition, as the fats, in the form of cod-liver oil, and other hydrocarbons; then, preparations supposed to be given for their nutritional effect and also with the idea that they modified to some degree the evolutionary changes occurring in the tubercle, as the phosphates; calcium phosphate, etc. These, it was supposed, would bring about a calcareous degeneration of the tubercle. Third, the drugs given for the fever, because the old belief was that we should fight the fever with drugs, like quinine, the salicylates. The antiseptics, so called, have been more recently given. These comprise the various preparations of creosote and other drugs; the essential oils, clove oil and others, for inhalation. Alcohol used for its nutritional effect and to combat the fever; then, many preparations, as stated by Mr. Adams, intended to still the cough, and these contained injurious compounds, of opium, chloral, and other deleterious remedies. The layman believes, in many instances, what was taught by the medical profession twenty-five years ago. We have many examples of this. People believe in cod-liver oil, for instance, as a specific cure. Many believe in alcohol as a direct cure for the disease. Many believe that the fever must be fought and use drugs to that end. Now these were things that we ourselves believed about twenty-five years ago. Unfortunately, too, the medical profession, in large numbers, is not educated to a better belief and use drugs which are not indicated. This gives the people an excuse for using them and gives the opportunity for nostrum vendors to advertise their wares. One of the greatest dangers in the whole nostrum business is the recognition, by the profession, of the so-called ethical preparations. There are two classes of manufacturing pharmacists; those whose business is manufacturing drugs and making preparations after the formulæ of the pharmacopeia of the United States. In many instances they make special preparations of their own which are as harmful as those made by the so-called special manufacturers. Then we have the so-called special manufacturers, who get out preparations of their own and advertise under a trade-mark. These are usually nostrums and are put out under an alleged formula. A claim is made that they contain specific compounds, or mixtures, which have new virtues as compounded by the manufacturer which the ordinary

mixture would not have. This, of course, is untrue, but in America we are all taught to believe what we read; it is a part of our common school education. Many educated people believe what they read when they would not believe the spoken word. Now these special manufacturers not only do that, but they put up poisonous compounds in a secret way, as Mr. Adams has so well shown through Colliers'. The harm which such remedies as the acetanilid compounds, put out as "tonics" and "cures" for different diseases, have done cannot be overestimated. These special manufacturers are often combined. St. Louis, perhaps, contains more of these special manufacturers than any other one city. Many of them advertise themselves as the manufacturers of special preparations when they do not make them at all, but have them put up by the general manufacturer in large quantities. These are the people who are doing more harm than the general patent medicine people. They hoodwink not only the laity, but the medical profession as well. Antikamnia is a good example of this. It was first brought to the medical profession and now is sold everywhere, even in department stores. It is an acetanilid compound. These people use the medical profession as middle men to advertise their wares. It is not only the patent medicine men, whose methods have been so well exposed by Colliers and others, but these special manufacturers who are doing great harm and we must meet this evil by educating the physicians as well as the laity. We are gradually, I think, accomplishing this in the profession. As a body the medical profession is a noble set of men. No class of people sacrifice as much in physical comfort and who want as little, taking everything into consideration, as the physician. The same amount of time spent in almost any other avocation would make larger returns in money. Certainly there is nothing to stimulate a man to enter the profession as a means of pecuniary gain, so that as a rule the men in the profession are of a high average intelligence and are philanthropic. They want to do right and help the people, but unfortunately many of them are so situated that it is difficult to keep abreast of the times. Consequently we should be cautious in condemning what they do, but we should try to meet them and assist them the best we can, and this we are trying to do, and we are succeeding. The difficulty is to reach the people through means of publication. Colliers, with its large circulation, reaches comparatively few of the people that it should touch; 99 out of 100 do not have the opportunity to read it.

The American Medical Association is now organizing all over the country, in every state and in every county, and gradually every licentiate in the Union will be brought into the organization. These men meet and discuss these important questions, and many of them with whom I come in contact tell me they had not given the matter consideration before, but that now that their eyes have been opened to the condition of things they will not write prescriptions for these things again. The profession will be reached through our state and local organizations and through them we will get at the people. The Proprietary Association of America, with a great deal of money back of it, is fighting the matter hard. In many instances those firms which call themselves ethical are members of that association and are fighting with them. But there is a great movement on and the medical profession has with it now what it never had before, many of the lay forces. With such publications as Colliers and the Ladies' Home Journal back of us, I believe we shall not fail to educate the people to a proper knowledge of the subject.

The Chairman: The movement, as described by Dr. Billings, is like the advance of a great army; while one wing is advancing upon the laity, the other is advancing upon the medical profession. If, as Dr. Billings has said, what was taught by the profession twenty-five years ago is believed now, the profession has an additional responsibility for being right about what is taught now, because it may influence belief for twenty-five years to come.

Dr. J. Willoughby Irwin, Philadelphia: In looking up the subject of tuberculosis nostrums in Philadelphia I had occasion to inquire of a great many druggists the character of the people, the way they come to get the prescriptions for nostrums and why some of them come to the druggist. The first question was answered almost always, "by the lower class"; they were the people who bought the most of these. Some thought it was due to the fact that they did not want to pay the ordinary fee to a physician and then go to the drug store and pay almost an equal fee for the medicine; they tried to even things up, they thought, by buying something that would at least do them no harm and that would probably quiet the cough, their idea being solely to get rid of the cough, not taking into consideration at all the other symptoms of the disease. Many druggists said, however, that there were people of wealth who came to buy such remedies as Piso's Consumption Cure, Dr. Bull's Cough Syrup and Father John's Cure. One told me that

a patient of mine, who I thought was living up to the rules laid down for him, repeatedly bought Father John's remedy to quiet the cough, saying that I was treating his stomach but not the cough, which gave him the most trouble.

Another question that I took up with the druggist was how often these people buy the preparations on the advice of physicians and I was surprised to find that there were a number of men who did not take the trouble to treat the disease, but as soon as they made the diagnosis would advise these patients to go to the drug store and purchase one of these three remedies. I was surprised to find that it was those who represent another branch of the profession, not using drugs but treating cases in a different manner from what we do, who were the ones that advised the people in this manner; also a few graduates of good medical schools. Now that is a phase of the subject that is going to be very difficult to overcome. The daily papers and various periodicals have done yeoman work in trying to eradicate this evil and we must combine and fight with all our strength if we are to succeed. We must educate the people, not only through the papers, but through the public schools, reaching the children, through their teachers. One druggist suggested to me that if a course of lectures on the subject could be given in the pharmaceutical schools he thought it would have a far reaching effect. He believed, too, that if many of the druggists could be shown that they were selling drugs to people which practically caused their death they would cease to sell them. It was a good suggestion and we should act upon it if possible. Then we must endeavor to reach the teachers throughout the country. They can, in their talks upon physiology, etc., convey to the children the proper ideas upon this subject.

One of the difficulties is that when you are treating a patient for tuberculosis and they think that the cough is not disappearing quickly enough for them they will go to the drug store and buy preparations containing opium and other harmful drugs, which it is true will control the cough in some cases, but which in the advanced cases at least hastens death. Then as to alcohol; we all recognize the harm it is doing with this class of patients. It is true that in the first stages it may be of value, but the people are not capable of understanding when the disease is in the initial stage. I think, as members of this Association, it is our duty to have a committee appointed to take charge of this crusade against tuberculosis nostrums and that the committee should

be given powers as great as it is possible for them to have. In order to overcome the evil we must fight it in the same way, with the same methods, that the nostrum vendors use to sell their medicines. One druggist suggested to me that we use this method, which is employed by many of these proprietors, of writing to druggists and asking them to give the names of five or more people who are taking cough syrups. These proprietors do that and then send them literature concerning their remedies. We might imitate them, sending our literature for their education. It might enable us to reach a number of people that we cannot reach otherwise. We must reach these people, either through the press, or in some of these ways suggested, and educate them, and I trust the time will come when we will be successful.

Dr. Edward L. Trudeau, Saranac Lake: I only desire to say a word in the discussion of this subject as to the value of education. In Saranac Lake we have a large invalid population, and yet quackery has never obtained a foothold. Patients are so familiar with the etiology of the disease and with the only recognized methods of treatment that it is difficult to induce any but the most hopeless cases to try quack treatment of any kind. It is the education that comes through the physician that is the greatest safeguard against this patent medicine evil.

Dr. Dunning S. Wilson, Louisville: I cannot refrain from saying a word in this discussion in defense of the druggist. I am a teacher of pharmacy and so feel competent to speak to that subject. The druggists, as a general rule, are opposed to selling patent medicines for two reasons; first, there is not enough profit; and, second, they have just as much conscience as practitioners of medicine, but the people demand these remedies and the druggist hands them over without venturing the advice not to take them. We are dealing with a trade as well as a profession. These men are in business and when not asked any questions they feel that they have a right to sell the preparations without giving advice.

TUBERCULOSIS AMONG THE OGLALA SIOUX INDIANS

By James R. Walker, M.D.

Pine Ridge, S. D.

A larger proportion of the population of South Dakota are tuberculous than that of any other state in the union, except California, Tennessee, and Kentucky. This is not because the unavoidable conditions of South Dakota favor the development or progress of this disease, for they are salubrious for every form of tuberculosis, but it is because so large a proportion of the population are Indians, who are effected with this malady to a much greater extent than are the white residents.

The Pine Ridge Reservation is in South Dakota, and has the largest Indian population of any reservation in the state, and the second largest of any i nthe United States. This population is 6,686, of whom 4,870 are full-blood Oglala Sioux, and 1816 are mixed bloods. The distinction between full bloods and mixed bloods is made, because the differences between these two classes of people are so great and so many that to consider them indiscriminately in social statistics of any kind would give erroneous conclusions in regard to both. For this reason the Indians referred to in this paper are only the full blood Oglalas.

For ten years an effort has been made to keep reliable sanitary and vital statistics, and statistics of other social factors that might have an influence on the health of these Indians, and advantage has been taken of every opportunity to secure reliable information relative to these matters previous to the time when these statistics were begun.

The data obtained in this manner form the basis of this paper, in which tedious statistical details are avoided, and only conclusions are given. It is intended to give only such conclusions as are justified by the recorded facts.

While these are stated as positive assertions, the possibility of their being erroneous is fully recognized, and the author will be more thank-

ful for a conviction of error than he will be for an approval of his thesis, for he desires to be right in this matter, which concerns the very existence of a people.

Tuberculosis among these Indians does not differ in any respect from this disease among white people. The infecting material is the same, and is produced and disseminated in the same way, individuals are infected in the same manner, and the disease runs the same course, produces the same results, and is subject to the same measures, remedial or provocative, as it is among the white people. It does not show any especial affinity for the Indian, nor affect him under any condition where it would not affect a white man.

There is no inherent peculiarity of the Indian which renders him more liable to infection with tuberculosis than is a white man under like circumstances.

The average length of the new born Indian infant is 19.5 inches, and its average weight is 7.5 pounds, which is a little longer and heavier than is the average infant born of white parents in the United States. So it appears that the Indian infant begins life with a little better physique than does the white infant.

The growth of the Indian through childhood and adolescence, as compared with that of the whites, is normal.

They arrive at their full stature, the male at 23 and the female at 21 years of age. The average height of the adult male Indian is 69.57 inches, and of the female 64.5 inches. This makes the average height of the male Indian 1.9 inches above that of the average male white of the United States, but as I have no statistics relative to the height of the white women, no comparison of the heights of females is made.

The male Indian increases in weight until 45 years of age, when the average weight is 161 pounds, which is six pounds heavier than the average weight of the white man. The female increases in weight until 50 years of age, when the average weight is 153 pounds.

The average measurement of the chest of the male Indian is 38.75, which is .25 of an inch less than that of the white man. The average of the female Indian is 36.5.

The average expansion of the chest of the male Indian is 3.25 and of the female 2.75 inches. These measurements indicate that the respiratory organs of the Indians are normal.

The average strength, endurance, and vitality of these Indians appears to be about the same as that of the whites.

It thus appears that the persons of the Indians are as well adapted to fulfill the requirements of a healthy life as are those of the whites.

Yet there is a much larger proportion of these Indians infected with tuberculosis than there is of the white people. This must be the result of external conditions that do not especially pertain to the Indians.

To learn what these conditions are is of the greatest importance, not only to these Indians, but to mankind.

Tuberculosis existed among these Indians before they came into contact with the white people, but at that time the disease was rare among them, and remained so until they changed their nomadic to a settled life in houses.

When they began to live in houses tuberculosis began to increase among them, so that the conditions which caused this increase must have been different from those surrounding them when they lived in tepees.

They were filthy both when they lived in tepees and when they lived in houses. It was statistically demonstrated that those who were the most cleanly were less liable to infection by any disease than were the most filthy, and, conversely, that the most filthy were the most liable to infection of every kind, but there is no evidence that this filth ever caused tuberculosis, except when it was mingled with the specific germs of the disease.

In their primitive life, the principal food of these Indians was flesh. Sometimes they had this in an abundance, and sometimes they had little.

In time of plenty they would surfeit upon raw or poorly cooked meat, and in times of scarcity they would go hungry. They had no meal times, but ate when inclined or opportunity offered.

Notwithstanding this unsanitary way of eating, they were comparatively free from tuberculosis.

When they began to live in houses the Government supplied them with an abundance of food, and in a much greater variety than they had been accustomed to. It also supplied them with cooking stoves and utensils, so that their food was better cooked than it was when they lived in tepees.

Coincident with this increase of food, prepared and taken in a more sanitary way, was the increase of tuberculosis among them.

But it was demonstrated that those who prepared their food the best, and in the most cleanly manner, and took it in moderation and at

regular intervals were freer from infection of every kind, including tuberculosis, than were those who glutted themselves upon food filthily prepared and insufficiently cooked. But the question of food was only the question of fortifying the system more or less securely against infection, for there is no evidence that food of any kind, including tuberculous beef, ever caused tuberculosis of any Indian.

During their savage life the clothing of these Indians was of skins fashioned after a primitive style, the same for every season of the year, except that the robe was added in the winter time. They never laundered them or changed them for purposes of cleanliness. At this time they were often subjected to inclement weather with insufficient clothing, and often slept with insufficient covering to keep them warm. They often were exposed to great hardships and to exhausting physical exertion.

But the evils of poor clothing, hardship and exposure were offset by the invigorating effects of their outdoor life, and they were less vulnerable to infection of every nature than they were afterwards.

When they began their settled life in their houses they were provided with better clothing in sufficient quantity, and they were supplied with blankets and bedding sufficient to keep them comfortable at night. The reasons for their exposures and hardships were removed, and they led a much quieter and easier life. But with these improved conditions there was an increase of tuberculosis among them. The benefits of their better clothing and their relief from hardship and exposure were offset by the debilitating effects of the sedentary life they began to live.

Their tepees were so constructed that they were amply ventilated at all times. They were moved often, and each time were thoroughly freed from dust, and renovated before setting up. When living in them they threw their slops about the door, but moved before these began to putrefy.

In the tepee the handiest place to spit is in the open fire in the center, and the Indians habitually did this. So that the sanitary condition of these tepees was good at all times. They were too small to permit of many crowding into them, and were moved so often that neighborly relations were constantly changing.

Such a life in such habitations would tend to promote a vigorous constitution, and to fortify the system against infection of every kind, and it would tend to prevent the accumulation of infecting material, or the subjection of many persons to it.

When these Indians were gathered onto a reservation, the governing policy was to get them settled in fixed homes, and they were urged to build houses. But no plan for building, or instructions as to the sanitary requirements of a house was supplied them. They built their houses small and low, with tight dirt roof and the ground for a floor, with every crack or crevice stopped with daubing for the purpose of preventing ventilation.

A heating and a cooking stove were provided for each house, and in cool weather these were both fired at once, and the Indians would crowd into these superheated cabins and swelter there. If the door of such a place were opened on a cold day, the exhalations of the inmates would condense in a cloud that was stifling to one unaccustomed to such air.

Such conditions of life were debilitating, and lowered the resistance to morbific agencies of every kind.

They threw their slops about the door as they did when living in tcpees; but they could not move away from them, and their surroundings soon became noisome with filth.

They would make prolonged visits, two or more families crowding into rooms not large enough for one, and thus pollute the air and the surroundings at double the rate.

These Indians began the use of intoxicating drinks before they began to live in houses, and before tubreculosis began to increase among them.

There is no evidence that this ever caused tuberculosis among them; but it was demonstrated that it did produce a condition that was favorable to infection with tuberculosis and to hasten its development and increase its virulence.

None of the conditions that have been mentioned, nor any other that was investigated, were sufficient to account for the increase of tuberculosis among these Indians at this time, except when taken in connection with the presence of the specific infecting material of the disease.

From time immemorial there were a few cases of tuberculosis among these Indians. When they lived in tepees the conditions of their lives were such that the infecting material was reduced to the minimum, and their resistance to infection raised to the maximum, and the opportunities for infection were few. Consequently the number of cases were few.

But when they lived in houses these conditions were all reversed.

The conditions of life aggravated the disease of those sick with it, increasing the infecting material. They debilitated all and increased their susceptibility to infection, and crowded them together in the presence of the infecting material. In fact all the requisites for the propagation and spread of the disease were supplied.

Where statistics were obtainable they showed that every new case of tuberculosis had been exposed to contact with the waste products of the disease before they showed infection, clearly establishing the fact that they were infected by this means. It is reasonable to assume that every case of tuberculosis among these Indians became infected in this way.

This accounts for the increase of tuberculosis among them, and no other theory does so.

Thus the reason for the preponderance of tuberculosis among these Indians becomes as simple as would be the reason for the preponderance of smallpox among them if they should expose themselves to infection by that disease, as they have to infection with tuberculosis.

Just as smallpox can be prevented among them by preventing their coming in contact with its specific infecting material, so can tuberculosis, as has been demonstrated by the following experiment.

In 1896 it was asserted that more than one-half of the Oglalas were tuberculous, and that more than seventy-five per cent. of the total number of deaths among them were caused by this disease. This was an exaggeration that is common in discussing tuberculosis among Indians.

The facts were that there were at that time 4,983 Oglalas, of whom 741 were tuberculous, and of these 124 died that year.

That is, 148.7 per 1,000 were tuberculous, and the annual death rate from this disease was 24.88 per 1,000. As the entire annual death rate was 52.88 per 1,000, the deaths from tuberculosis was but 47 per cent. of this.

But this death rate was appalling, for the annual birth rate was but 41.34 per 1,000, which showed a decrease of 11.64 per 1,000 because of the excess of the death over the birth rate.

As the percentage of the deaths from tuberculosis was so great, this disease was exterminating this people.

At this time the control of this disease among these Indians was undertaken.

The following premises were assumed:

Tuberculosis is an infectious disease caused by a specific material.

This material is mingled with the products of the disease, and is not produced naturally otherwise.

When discharged from the body with these products of the disease this material may be collected and destroyed.

If this infecting material is prevented from coming in contact with the uninfected tuberculosis will be prevented.

The plan was to impress these Indians with an effective understanding that tuberculosis is always caused by the infecting material coming from one who has the disease. That this infecting material is contained in the sputa of consumptives and the discharges from scrofulous sores.

To use every means for preventing this material from coming in contact with the uninfected. To get the infected out of their houses and into their tepees again, or into tents, and keep them in the free air and sunshine as much as possible. To prevent their mingling with the uninfected as much as possible, and to carefully collect the products of the disease, and destroy them before they may come into contact with others.

It was not expected that this plan could be brought into effect at once; but it was intended to develop it as fast as circumstances would permit. At first the authorities gave hearty support to this work, and the cooperation of the Indians was secured beyond expectation, so that the work was made effective according to the plan much more rapidly than had been anticipated.

Tuberculosis was steadily and continuously reduced among these Indians for five years from the time this work was begun, when the proportion of tuberculosis was found to be reduced from 148.7 to 105.4 per 1,000, and the annual number of deaths from this disease from 24.88 to 13.45 per 1,000.

That is, tuberculosis was reduced nearly one-third, and the death rate from it nearly one-half.

There would, doubtless, have been a greater reduction had these Indians been so situated that better supervision could have been given them; but they were scattered over a territory as large as the state of Connecticut, and it was impossible for one physician to give to all the personal supervision necessary to keep them from lapsing from the sanitary work required of them to produce the best results.

After five years of this work the physician who had charge of it was deprived of the opportunity of giving it his personal supervision, and

the Indians became neglectful of the sanitary conditions that had been required of them, and consequently tuberculosis began again to increase among them. When they observed this they lost confidence in the efficiency of their work, and because there was no one whom they considered authority on the disease to supervise them, it became intermittent and ineffectual.

Thus the disease has increased at an increasing ratio, and now the proportion of tuberculous among them is 120.64 per 1,000.

As all the conditions of these Indians, except those affected by the effort to control the disease among them, have remained the same, before, during, and since this effort was made, this proves the soundness of the premises assumed before beginning it, and, also, that tuberculosis can be suppressed among them.

Because of the above facts the following proposition is submitted:

A practical method for suppressing tuberculosis among these Indians would be by the establishment of a sanitary camp, where all that are infected with the disease should be collected and maintained under competent supervision until each case shall terminate.

DISCUSSION ON TUBERCULOSIS AMONG THE INDIANS

Dr. Martin, Browning, Montana: I have concluded in view of the limited amount of time and space at my disposal, that a statement by me as to the administration of my office of agency physician, my observations as such, and the difficulties I experience in caring for tuberculosis among the Indians will prove of more benefit to your honorable body than any attempt on my part to discuss the subject from a scientific standpoint, or the offering of any suggestions by me as to its prevention and cure.

I have been agency physician for the Blackfeet Indians in Montana since July 25, 1893. I have kept an accurate record of all deaths occurring during this time among these people from whatever cause. This record shows that 65 per cent. of all deaths have been due to tuberculosis in some form, many of the cases being afflicted with several forms of the disease. I have seen a youth of eighteen years die of pulmonary tuberculosis who had lost part of both hands in amputations by me in an effort to eradicate tuberculosis of the bones and whose neck and chest were almost a solid cicatrice from the glandular and cutaneous forms of the disease. I have seen old men and women of

eighty-five die of this disease and seen still-born infants whose failure to live could be traced to the same cause.

As to variety or tissue affected, the glandular is the most common, with the pulmonary a close second, the two generally being present as the patient passes from childhood to adult life. The pulmonary variety is slowly becoming more common and bids fair to be in time the most prevalent.

The older Indians, possessing rugged constitutions, often live to an advanced age, even when affected for years; the younger generation, possessing less stamina (for reasons to be afterwards stated), prove victims to its ravages in childhood or early life.

The infant mortality among these people is something appalling; so great, that were it in one of our cities it would demoralize the Board of Health and attract the attention of all the thinking people in the community. This, when not due to the actual presence of tuberculosis in the infant, is, in a number of cases, due to want of vitality in one or both parents from the disease.

Tuberculosis is prevalent among these people in all of its forms, no tissue or organ escaping. In my opinion 75 per cent. of the full-blood Indians on this reservation at some period of their lives are affected by this disease in some form; the part-bloods are less susceptible. This is due in my opinion to the admixture of new blood and the better conditions under which they live.

Here I would like to quote from a letter recently received by me from Doctor T. M. Bridges of Idaho Falls, Idaho, who spent ten years among the Indians of the Northwest as agency physician: "For ten years I kept an accurate record of all deaths from every cause and during that time I saw 150 deaths from tuberculosis in an average population of 1500, which is a death rate of 10 per 1000; the deaths from this disease were always just about half the deaths from all causes. . . ."

From my observations I am convinced, with the present facilities and under the present conditions existing on our reservations, the rapid spread of tuberculosis cannot be prevented, much less its eradication accomplished. It would seem that the extinction of the remnants of the once powerful tribes of American Indians that peopled the prairies of our Northwest is only a question of a short time, unless radical changes are made in the methods employed in dealing with this scourge, and even then in my estimation their preservation is doubtful.

According to the best information obtainable by me tuberculosis among the Blackfeet was unknown until they came in contact with the white race, or at least very rare. This is easily understood and appreciated when we remember that in his aboriginal state the Indian lived under almost identically the conditions in which we place our patients in the most modern and successful treatment of the disease. His whole life was spent in the open air; in the tepee in which he slept ventilation was perfect; he was supplied with an abundance of good nutritious food exactly suited to his needs and nature.

The causes that have changed a race noted for their strength and vitality to a community of invalids whose very existence seems threatened, are so numerous that to properly present them would require a paper much longer than this one can be. Most all observers have a theory, many of them several, and all are in a degree correct. I will detail some of the exciting causes of the spread and prevalence of tuberculosis among these Indians, in the order in which they seem important to me. The whole is to be found in the semi-civilized condition in which they have lived since the white man has taken charge of their destiny. I have even doubted the Indian's ability to survive (as a race) the changes incident to the civilizing process if carried out under conditions much more ideal than any we can hope for.

1. The change of abode from the perfectly ventilated tepee, the location of which was changed almost daily, to permanent dwellings, usually of the following description: a close log cabin with one door and at most one window (often only a half window) and that immovable. Let me try to present to you a condition of frequent occurrence in my practice here: a cabin of the above description, inhabited by a family of at least five people, one member (often more) of which has tuberculosis, expectorating millions of germs anywhere, everywhere, on the floor (often of dirt), on the bedding (which is usually on the floor), on their clothing, on the furniture, etc., etc. The temperature of the room (if in the winter season) around ninety degrees, the window tightly closed and impossible to open, the door opened only to admit visitors till I have counted twenty people sitting in a cabin sixteen feet square amid the dirt and filth apparently accumulated for years; on a string or pole overhead is hung their principal article of food—the dried meat,—which must often be infected from the dust arising from the floor. This is the atmosphere that they breathe in the winter season, in which they cook, eat and sleep, visitors as well

as members of the family; visitors who, thus infected, go to similar homes and form an endless chain of infection. I have often seen this condition in the houses and the temperature out-doors anywhere from ten to thirty degrees below zero. The exposure incident to necessary trips outside can well be understood.

2. This tribe has lived within itself for a great number of years; intermarriages were unavoidable till at the present time the degree of consanguinity is really unknown. This inbreeding has lessened their vitality till in my opinion it has become a factor.

3. Under the discouragements of reservation life, as he has lived it during past years, the Indian has become careless of his personal cleanliness and habits and learned to drink whisky and do many other things that are factors tending to the increase of tuberculosis among them. There are many other important exciting causes; these mentioned are in my opinion the greatest and will serve to explain in a measure the spread and prevalence of the disease in this tribe.

As to the difficulties to be met by a physician among them in caring for this particular disease, they are so many and so nearly impossible to overcome, so self-evident in view of what has been said above, that it seems unnecessary to mention them without making some suggestions as to changes. To begin with my patients are scattered over a territory sixty miles square, many of them living in houses and in surroundings similar to those described above, which explains many of the difficulties encountered; the impossibility of securing proper care and nursing of patients, together with the want of coöperation on the part of the patient and his friends is another of the great difficulties to be met. It should be remembered that for want of facilities and knowledge many regulations and sanitary measures can not be carried out by the Indian be he ever so willing.

The Indian of the Northwest lives in a climate which, while healthy when a person is supplied with plenty of clothing and sufficient nutritious food and surrounded by good sanitary conditions, is still a rigorous one in which the range of temperature is very great and exposure constant. Catarrhal troubles of the respiratory organs are common with these people from childhood, due to conditions that it is impossible for the physician to remedy, little care being taken of the children by the parents, they being allowed to run out doors in all kinds of weather, thus becoming perfect subjects for the invasion of the disease and falling early and easy victims.

The Indian knows no rational medicine. One great difficulty is to persuade him that his life and that of the members of his family depend on the observance of certain well known rules of health, the importance of which he is entirely ignorant of; more than this, it is often impossible to get him to take his medicine regularly; he expects results impossible with our present knowledge of the treatment of tuberculosis.

As to the food question, my experience is that, from the standpoint of nutrition, many Indians on this reservation are in a constant state of semi-starvation, those having food in sufficient quantity lacking the knowledge to prepare it in a wholesome manner. It is pitiful to see a child of tender years sick with tuberculosis (a disease requiring good nutrition above all else) trying to abstract a meal from a piece of dried meat in appearance and hardness not unlike the sole of a cast-off shoe.

All of the above as to habits and conditions of living must be understood to apply mainly to the full-blood Indians, there being upon this reservation a well educated, thrifty class of mixed bloods who live under conditions equal to that of the ordinary white community; and while often victims of the disease, they are less subject to it and when attacked live longer under treatment.

Of the danger to the white communities surrounding these reservations, much might be said. In my opinion, it has become a vital question to the public at large as well as to those responsible in an official way for the care of the Indians.

Dr. Norman Bridge, Los Angeles: I want to compliment Dr. Walker on the thoroughness and scholarship of his paper. It is one of the most illuminating and masterful I have ever heard at a scientific meeting. He has demonstrated what I have long believed, namely, that tuberculosis spreads because of lack of fresh air as well as by the distribution of the germs of the disease.

I want to ask him if he has made any observations among the Indians as to the effect on the probability of pulmonary tuberculosis occurring among those who have previously had tuberculous glands of the neck and elsewhere. I am led to make this inquiry by the experience of Dr. Lake, who has had charge of a reservation for Indians in western New York, where he has observed, and believes he has demonstrated, that tuberculous glands of the neck lessen the likelihood of the individual acquiring pulmonary tuberculosis later in life. He found that among the people who had scrofulous scars the proportion of pulmonary tuberculosis was only about one-half what

it was in unscarred individuals. If that is true, then it would seem that early tuberculous disease of the glands enables these patients to develop some anti-body that gives them a greater resisting power.

Dr. Jas. R. Walker, Pine Ridge: Replying to Dr. Bridge's question, I have not any statistics on that matter, but have seen a number of cases of pulmonary tuberculosis in patients who had had glandular tuberculosis earlier in life. I do not think there is such an immunity as the doctor speaks of. Certainly a large number of glandular cases do develop pulmonary tuberculosis later.

Dr. Geo. M. Kober, Washington: My sympathies are very much with the Indians, among whom I lived, in the capacity of military surgeon, for eighteen years. I think Dr. Walker has struck the key-note of the whole situation. He has given us the most rational predisposing cause among these people, which is the radical change as regards their housing conditions and food, and I regret that the government has been so slow in appreciating that these factors need to be corrected. We have taken the Indian from his tepee without a suggestion to him of how he may build a sanitary home. They have been practically taken from a well ventilated habitation, the tepee, to live in what may be termed a prison cell large enough for one or two people, and which has to accommodate a family of five or more, and we have been perhaps lax in teaching him how to select their food and cook it properly. Personally I realize that proper nutrition and proper housing conditions will do more towards the prevention of tuberculosis than any other factors, and I feel like offering a resolution that the special attention of the Commissioner on Indian Affairs be called to the very able paper of Dr. Walker's, with this possible addition, that all Dr. Walker's recommendations should be applied with equal emphasis to those who are still free from the disease. We need these preventive efforts among these people to whom we owe so much. We have taken their very homes and are leaving them to practical destruction by irrational methods of civilization.

TUBERCULOSIS AMONG THE NEGROES

By Thomas Jesse Jones, Ph.D.
Hampton, Va.

My first aim is to show the tremendous importance of the study and prevention of tuberculosis among the negroes of the United States. While it is well known that this disease is quite prevalent among negroes, few if any of us know the extent of this prevalence and I fear that none of us realize the serious effect of this prevalence upon the vitality of the nation and particularly upon that part which dwells in our cities.

The seriousness of the problem presented by the consumption in any race depends upon three facts:

First, the extent of the disease within the race.

Second, the proportion which the race forms of the total population.

Third, the proximity of the race to other races.

One glance at Chart I shows that the death rate for the colored people is from two to seven times that of any other race, with the exception of the Irish, whose death rate is about two-thirds that of the colored. As to the extent of consumption, this chart proves that the negro death rate is far greater than that of any other people.

A comparison of the proportion which these foreign peoples form of the total population emphasizes the seriousness of the condition among the colored people. While the negro people are eight million and a half, or eleven per cent. of our population, only five of the twelve nationalities here mentioned are over a million in number. The Germans number six millions and a half, but their death rate is only one-third that of the colored. The English, the Canadians, and the Scandinavians are each a little less than two millions. With a death rate of less than a third of that of the colored, their tuberculosis problem together with that of the other nationalities noted on the chart becomes almost insignificant. Only the Irish offer a tuberculosis problem which is at all comparable with that of the colored. But the proportion of the

Irish is only one-half that of the negroes and the death rate is only two-thirds. Combining these two items of death rate and proportion, we can say that the danger to the nation of tuberculosis among negroes is four times that among the people whose mothers were born in Ger-

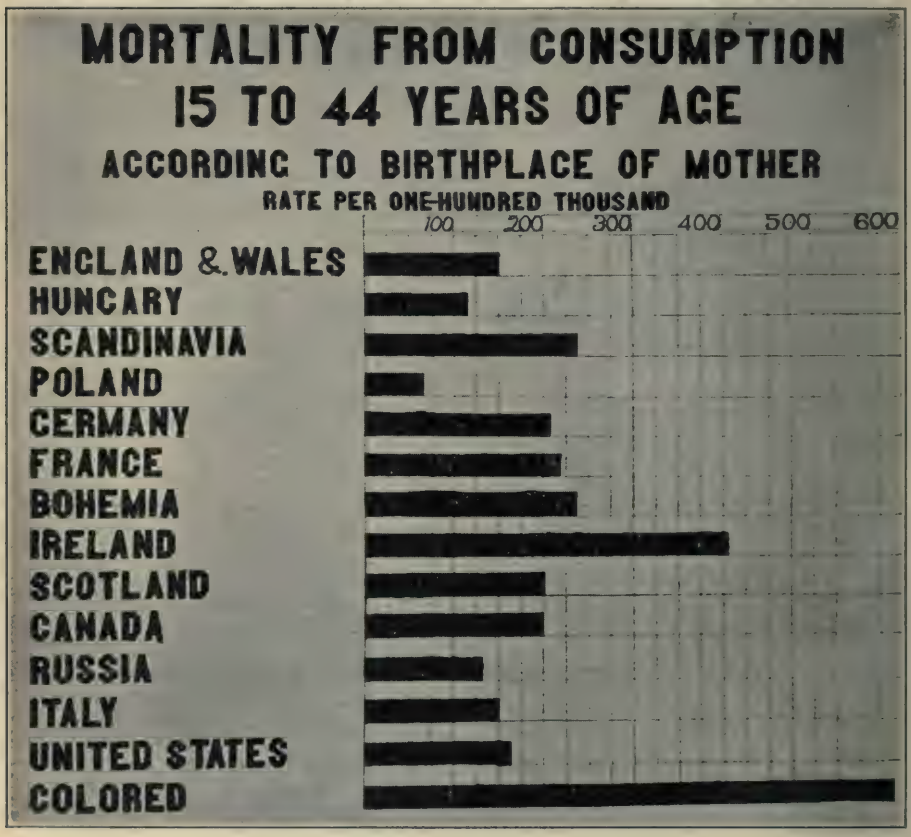

Chart I.

many, six times the danger among Canadians, fifteen times the danger among the Italians, and twenty times the danger among the Polish people in this country.

This danger is still further increased by the proximity of the colored race to the other races. We are deeply moved by the fact that the Indian race is succumbing so rapidly to this terrible disease, but the

effect of this high death rate upon the vitality of the nation is very small; first, because the Indian population is less than one per cent. of the people in the United States, and, second, because this small number is living apart from the other people of the country.

The extent of this proximity and the universality of a high consumption death rate is indicated by Chart II. In the cities of the South,

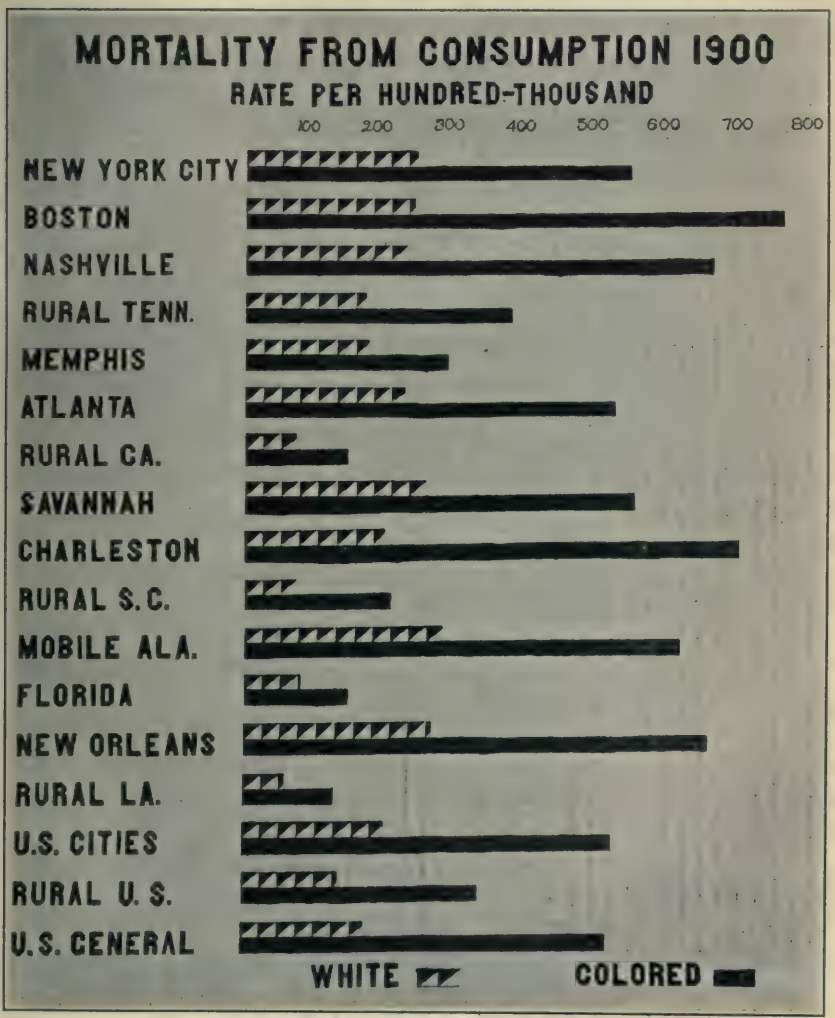

Chart II.

with a negro population ranging from 27 % in New Orleans to 56 % in Charleston, S. C., the death rate of the negroes from consumption is two and three times that of the whites. Though the proportion of negroes in Northern cities is small, the actual number is quite large. New York and Philadelphia, each with over sixty thousand negroes, have a very high death rate from tuberculosis. Boston, with a negro population of about twelve thousand, has the highest rate of negro mortality from consumption of any city in the United States. According to the census of 1900 for the District of Columbia, the mortality of the eighty-seven thousand colored people from consumption was 448, while that for the one hundred and seventy-two thousand whites was 403. Thus a little over half of the total number of deaths is credited to a third of the people. If, as was stated in *Charities* for May 12, there is one consumptive to every one hundred Washingtonians, it follows that there are one colored and one white consumptive to every two hundred Washingtonians.

This proximity is not merely that of the Italian laborer who works on the highways or in coal mines or on public buildings and dwells in a section of the city quite apart from others. The colored people of our cities are primarily engaged in domestic service. They are the cooks, the waiters, the porters. They wash the linen and clean the houses. They enter the sleeping room, the kitchen, and the dining room. They are the nurses of the children and in a hundred ways touch the innermost parts of many homes.

A study of Chart III increases the conviction that consumption among the colored people should receive most careful attention. The highest mortality for whites is from nervous diseases, the highest for colored is from consumption. Over one-fourth of all deaths among colored people are due to consumption and pneumonia.

In view of all these facts, namely, that the mortality from consumption is higher for negroes than for any other people, that the proportion of negroes in the United States is greater than that of any other special class, that the race is so closely related to other races by its occupations, and that consumption is the most potent cause of mortality for that race —in view of all these facts, it would seem that this association, engaged in the study and prevention of tuberculosis, should take some definite steps to study and prevent this disease among negroes.

Having established the overwhelming seriousness of consumption among negroes in relation to the vitality of the nation, let us now state

the more important facts pertaining to the causes and extent of the ravages of this disease upon the negro race both past and present. And here let me make due acknowledgment for my facts to Miss Lillian

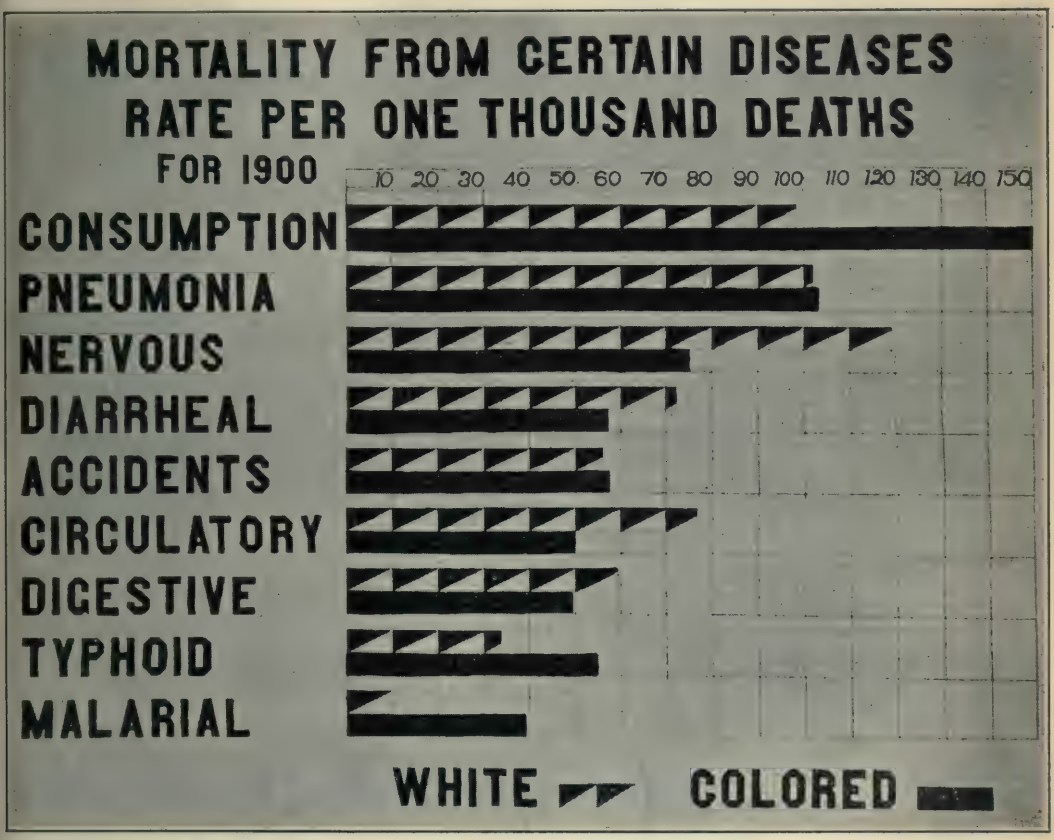

Chart III.

Brandt, Mr. Frederick L. Hoffman, the census of 1900, and the colored physicians who were kind enough to reply to my letters.

This chart, based upon facts obtained by Mr. Hoffman, supports the commonly accepted view that mortality from consumption among negroes was very much lower before the Civil War than it has been since that time. For the whites there has been a regular decrease from 1822 to the present time, with the one exception of the period 1875–

1884. The mortality for the colored, on the other hand, while slightly less than that of the white before the war, increased at a tremendous rate between 1865 and 1884 until it became two and a half times as great as that for the whites.

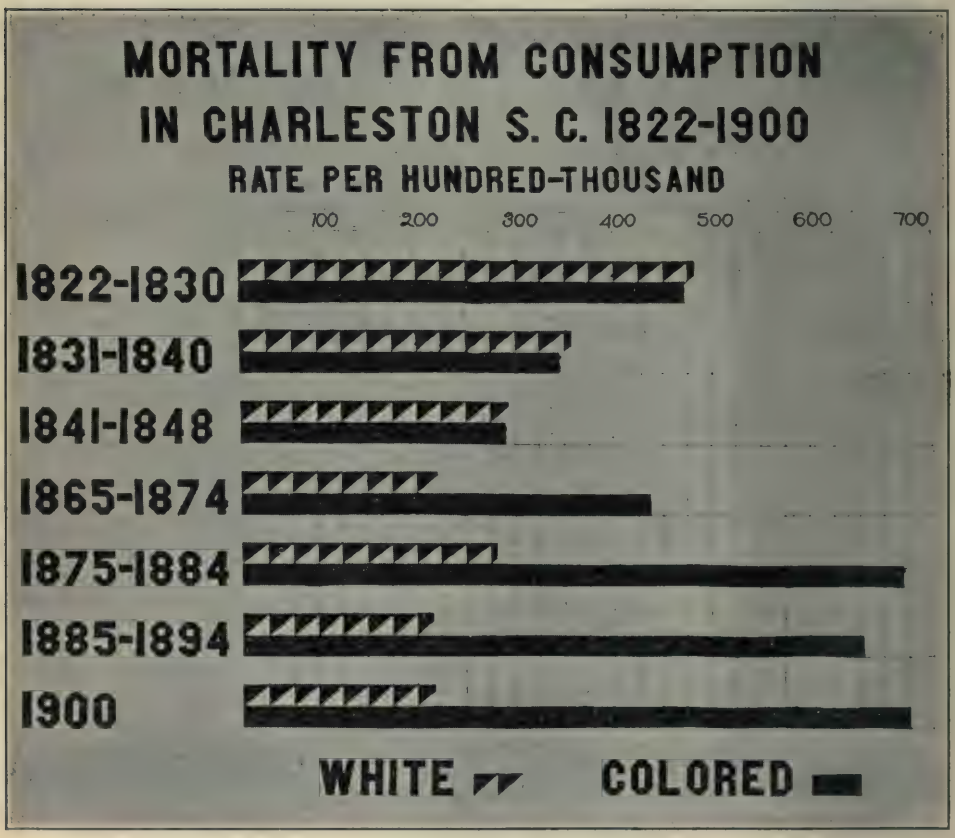

Chart IV

The movement of the mortality rates are very well pictured by Chart V, also based upon facts arranged by Mr. Hoffman. It is interesting to note that the length of lives for white and colored vary proportionately. From 1871 to 1880 there was a gradual increase in the rates for both races. Since that time there has been a corresponding decrease so that in 1900 the rate for the whites is slightly less than in 1871 and the rate for the colored has become the same as in 1871.

The most striking fact shown by this chart is the high death rate for colored children. While the rate for adults of the colored race is about twice that of the whites, the rate for colored children under fifteen years

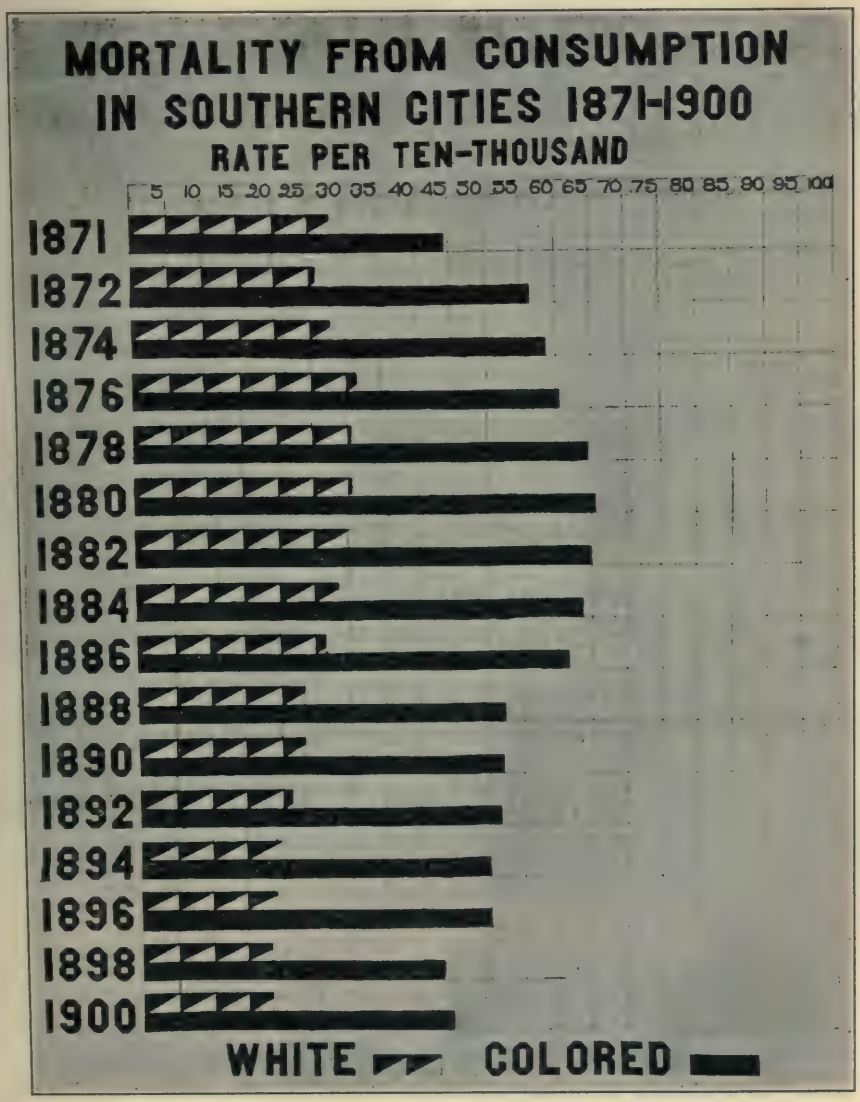

Chart V.

is over seven times that of the white children. The greatest mortality for colored is between the ages 16–44 years; that for the whites is at the ages 65 years and over. In this respect the colored race is similar to the Irish, the Italian, and the French.

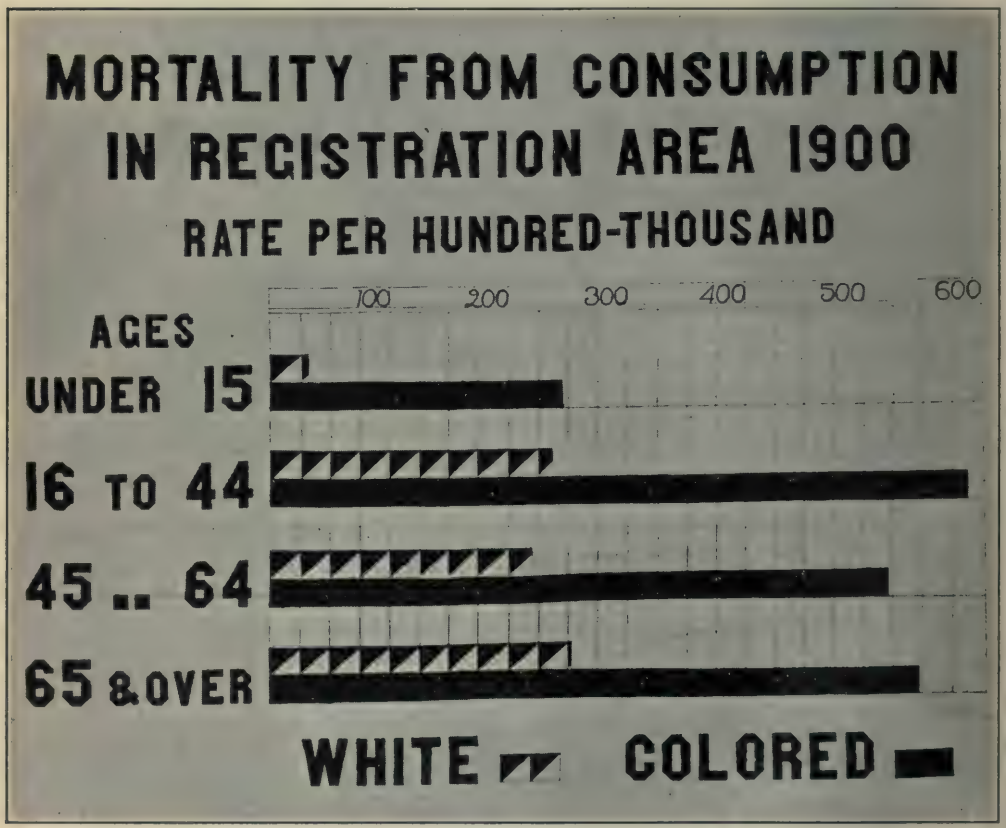

Chart VI.

I have deliberately avoided all discussion of causes in all that I have said in order to make clear the prevalence of the disease among the race and the seriousness of that fact in relation to the vitality of the nation. The discussion of the cause of the high death rate is profitable only in so far as it assists us in our efforts to stamp out the disease. This is a self-evident statement, but one that should be emphasized for the rea-

son that at this point friends usually become unreasonable and separate, the one class inclining to ascribe the prevalence entirely to racial characteristics and the other class ascribing it altogether to environment. Let me quote from an article by one who attributes the mortality to inferior physique and lower vitality. " The higher mortality of the negro popu-

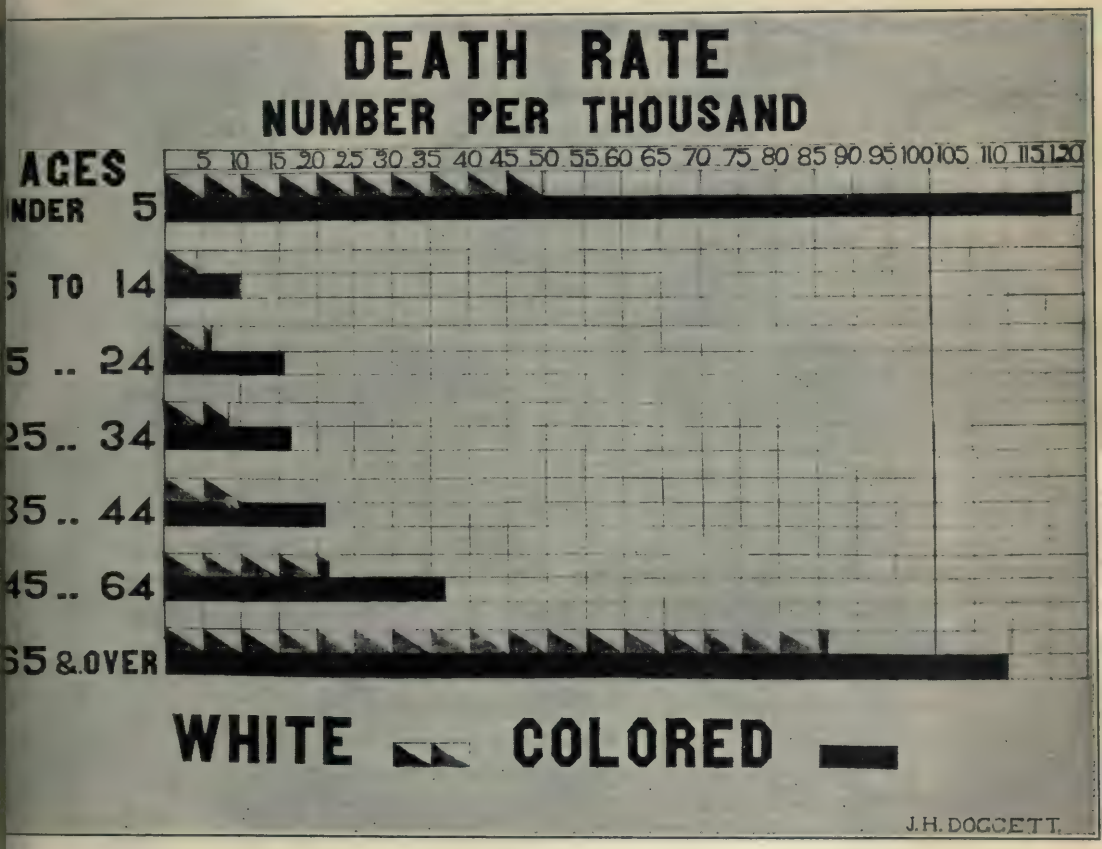

Chart VII.

lation from consumption and other tubercular diseases," writes this well-known statistician, " is, unquestionably, primarily the result of race." In the very next paragraph he writes regarding the decrease for the decade 1890–1900: " As far as it is possible to judge, the decrease in the mortality from consumption has been largely the result

of an improved environment affecting both races to practically the same extent." These two remarks seem to contradict one another. If race characteristics are primarily the cause, it would seem that improvement of environment would not affect both races alike. The extent to which the racial element enters into the cause of tuberculosis has not yet been determined. No individual or society has yet studied the case of the negro sufficiently to say whether the racial element plays any part as a cause of this disease. The influence of environment is so tremendously in favor of tuberculosis among this people that it has been practically impossible to eliminate it sufficiently to discover the racial element. Few of us realize the great difficulties under which this race struggles. In our cities they live in the poorest houses. Even those who can pay for better homes are often compelled to occupy unsanitary dwellings. A third of the race is yet living in one-room cabins. The possible danger of such an existence is indicated by a fact which I discovered last year in a so-called two-room cabin. Two-thirds of the space in one room was filled by a stove and a table, one-half of the other room was filled by a bed. In this house thirteen children had been born since the war and twelve of the thirteen had died when they were children.

Almost one-half of the race is illiterate. The consequence of such a degree of ignorance upon the health of the race is far greater than we can realize. One ignorant father whom I know has infected his wife and nine children. Seven of these children cannot walk. The man is now dead, but the consumptive mother at the brink of the grave continues to wash for the white people of that city and her two sons work in barber shops. The unusual and heroic struggle for an education under adverse conditions is often a potent cause of consumption among colored students.

The economic disadvantages of the race develop an environment which contributes much to the increase of mortality from consumption. It is well known that the majority of tuberculosis cases of all races are from the laboring and servant classes, and from that part whose weekly wage is $10 a week and under. This is true not only because the laboring and servant classes are numerous, but because the rate of mortality is higher for that class than for any other class of noticeable number. When it is remembered that over 80 per cent. of the negro race belongs to these classes, their economic disadvantages assume proportions which totally eclipse any racial predisposition.

It is not only in consumption that the race shows signs of its suffering. Its death rate is high in almost all diseases and the general death rate is higher than that of the white in almost the same proportion as that for consumption.

What is the cause of the tremendous decrease in birth rate for the last twenty years—a decrease two and three times as great as that for the whites? It is another evidence of unfavorable environment. It is the evidence of the suffering of a race struggling upwards under difficulties. For practical purposes the racial predisposition is a negligible quantity. There is enough to keep us busy for some years to come in correcting the more apparent causes of consumption among the colored people without losing any time or energy in quarreling over racial predisposition.

What is being done to change the situation?

I have searched diligently for any evidence of activity in behalf of the negro consumptive. The result of the search is very meager for two reasons; first, because the states and cities and colored physicians with whom I have communicated have neglected to answer my request for information, and second, because the efforts in behalf of the negro are "few and far between." The Charity Organization Society of New York City has an excellent committee at work on this subject. Washington has twenty-four beds in four shacks or tents located on the work house grounds for people too poor to go elsewhere. I am glad to note that the local authorities are awake to the conditions and the necessity for relief, and I hope that ample provision will be made for the colored as well as for the white. The Southern States are awaking to the need of sanatoria and legislative action for the prevention of this disease. Up to this time very little has been done even for the whites and I cannot discover that anything has been done for the colored consumptive aside from some free dispensaries and an outdoor department in connection with the State Insane Asylum for Negroes at Petersburg, Va. The medical associations of several Southern states are beginning to create public opinion favorable to the erection of sanatoria and in some instances special reference is made to the necessity of provisions for negro consumptives. Notable among these is the Virginia association, with Drs. Paulus A. Irving of Richmond and Grandy of Norfolk as a special committee, which opens its report with the following significant recommendation: "We recommend the organization of anti-tuberculosis leagues throughout the state for the education of the

people, not forgetting that the most important work is to be among negroes and the other working classes." Quite in line with this recommendation are the following words, written by Dr. Oppenheimer of Richmond, upon the sanitary conditions in that city: "If we wish honestly to reduce our death rate, we must extend our city limits and give more attention and money to the care of the negroes." The Richmond *Times-Dispatch,* commenting editorially on these words, wrote: "We talk much of our influence upon the black race; but we must never forget that the black race exerts a reflex influence upon us. If we do not help lift them up, they will help to pull us down." These sentiments must be encouraged. The 1,700 colored physicians of the land must be enlisted in the cause. The negro conferences held annually at Atlanta, Hampton, Tuskegee, and other schools for negroes must be interested in the subject. The colored ministers must be informed of the ravages of disease upon their people, and urged to speak to them about the disease. Southern states and cities must be aroused along the lines mentioned by Drs. Oppenheimer, Grandy, and Irving of Virginia, so that they may provide hospital and sanatorium facilities open to negroes.

DISCUSSION ON DR. JONES'S PAPER

Dr. Robert Wilson, Charleston: Those of you who live in northern cities, where the proportion of colored to white people is much less than in the South, will be unable to appreciate to the fullest extent the remarks of Dr. Jones as to the importance of this problem. The great extent of tuberculosis among the negroes constitutes a menace, as he says, not only to the colored race, but to the white population as well, because of the fact that they come into the closest relations with each other in every phase of life.

A few years ago, impressed by the importance of this problem, I undertook to study the statistics in our city, where we have very excellent opportunities for such study, with the hope of being able to throw some light upon the question. In the health office at Charleston we have a series of records extending from 1822 to the present time. In 1848 these were carefully studied and compiled, and it is from that compilation that Mr. Hoffman gathered his information. Taking up the work at this point, I carried it on to 1860, completing the ante bellum period; took it up again in the year 1878, omitting the war period and the decade following, when the records were not very accu-

rate. I have not trusted to my memory but have brought with me the statistics which I shall sum up for you. They appear to throw much light upon the nature of the problem of the cause of the prevalence of tuberculosis and the methods to be pursued in combating it. Having been brought up in the belief that prior to the war tuberculosis among the negroes was almost an unknown quantity, I was surprised to find that in 1822 the mortality per 100,000 of population was greater than it has been in recent years. It has been suggested that the cause of this was a widespread epidemic of whooping cough occurring at that time. During the following decade it decreased very much (reading from statistics). In 1848 the mortality was only 117 per 100,000 of population. Immediately after that there was a notable increase which continued until 1860 when the number of deaths were 466 per 100,000. Upon turning to the study of the population I find some interesting facts. The negro population did not increase steadily but varied considerably. The most probable suggestion is that this variation was due to movements of large bodies of slaves into and out of the city. The marked decrease in population in 1848 is said to have been due to a movement of the negroes to just beyond the city boundary where they could get houses at a lower figure. In 1820 the population was 14,000; in 1830, 17,000; by the next census, 16,000. Between 1840 and 1848 it decreased from 16,000 to 14,000, followed in the next two years by an increase to 23,000. During the next decade it again decreased, until in 1860 it was 17,146. Comparing the relative death rate during these years, we see a relation between the density of population and the mortality. In 1822 the death rate was very high, but that was probably due to a specific cause. In 1830, when the population was 17,000, the mortality was 333 per 100,000. During the following decade the mortality decreased with the population, 326 per 100,000 in 1840. In the following eight years, when the population decreased so rapidly, the mortality decreased likewise, from 326 per 100,000 to 117 per 100,000. Immediately after the increase in population it was noticeable that there was an increase in the mortality again. By 1850 it was 243 per 100,000, and during the following decade the figures ranged from 213 to 519 per 100,000, which is greater than it has been for the past year or two. Following the war we notice a wonderful increase in the prevalence of the disease. The first year after the war of which I have a record, 1878, there were 678 deaths per 100,000. From this time the mortality increased very much until in 1889 it was

920 per 100,000. Subsequently it began to decrease steadily until in 1900 it had fallen to 615 per 100,000. In the following years there has also been a steady decrease, until in 1904 the rate was 504. These figures are instructive.

The ratio of deaths from consumption among the whites is about the same as in other localities, consequently between two and three times as many negroes as whites, in proportion to the population, die of tuberculosis. The most striking fact perhaps that we get from this study is obtained from the comparison between the death rate and the population, which seems to indicate that there is a direct relationship between overcrowding and unhygienic surroundings and the disease, and that its prevalence among negroes is not due to a racial susceptibility.

The cause of the prevalence of this disease among the negroes may be summed up in two words—poverty and ignorance. They are too poor to live in proper quarters. We have no tenement houses in the South, but we have quarters that are equally as bad. I had occasion not long ago to go into one of these houses, an old stable or warehouse that had been converted into negro quarters, divided into a series of living rooms. It was approached from a covered way. In the rooms were no windows; no ray of sunlight ever entered. In each of these rooms one and in some cases more than one family were living. This is a condition of affairs that is fairly prevalent, the negro quarters in very many instances being similar to this. Because of their poverty they also lack sufficient food. Because of their ignorance they have an absolute disregard for the simplest rules of hygiene, and particularly do they seem to have a dread of anything approaching ventilation or fresh air. In our hospitals where we try to have them live properly we come into the wards on a warm summer day and find them with their heads covered up in the bed clothes. In the effort to stay the progress of consumption among these people the first thing to do is to provide for a proper sanitary inspection of their quarters. If it is possible they should be segregated and required to live together in one locality so that sanitary inspection may be the more easily and effectively carried out. Then we must educate them. Education is the most important weapon next to sanitary supervision. Perhaps they are not as teachable as white people, but I feel convinced that they are teachable to a very much greater extent than we have in the past supposed. Especially must we try to educate the more intelligent

classes, their school teachers, clergymen and physicians. By doing this I believe that we shall be able to accomplish a great deal.

Dr. Charles R. Grandy, Norfolk, Va.: I have listened to these papers with great pleasure and profit because I think the subject of tuberculosis among the Indians and among the negroes are so near akin that they should be considered together. To me it seems to be simply a question of how they live and how they are housed. Both are ignorant, both live in crowded quarters and keep out the air as much as possible, and both are susceptible therefore to tuberculosis.

Dr. Jones spoke of the question of education. Now there are two classes of negroes, one an educated class, who are much better than the ordinary ones and may be looked upon as the leaders of the race; then the other class which we have to consider as only children that need leading and we should expect the educated class to lead them. This second class is the one that gets tuberculosis. I think the education of these people depends largely upon whether they can earn better wages or not. If an average negro can live on six dollars a week and you give him a dollar a day, he will work six days; if you give him a dollar and a half a day, he will work four days. Now how are you going to help the negro in this matter if he will not take advantage of his opportunities? In our town we are trying to segregate the consumptive cases. The town authorities have recognized the danger and are trying to prevent it. Our statistics show that the percentage of consumptive deaths among the white people is high as well as among the negroes. Among the negroes it is between eighteen and twenty, and among the whites between eleven and thirteen. We must fight the disease in the negro in order to protect the white people. Some one has said that if let alone tuberculosis will finally settle the negro problem, but if so, it will settle a large number of white people at the same time.

Dr. S. A. Knopf, New York: This condition is due largely not to our neglect, but to the indifference or perhaps lack of training of the colored physicians and the colored people. The morbidity and mortality from tuberculosis among the negro race is of course as great in New York as anywhere else. To see what could be done to improve the conditions, our local Tuberculosis Committee called a conference a year ago, to which we invited clergymen and educators of the colored race. The first thing our colored friends wanted was a special hospital and dispensary. We did not give them a hospital but gave them

the use of our dispensary. Supervising their work at the clinic personally taught me that if there is anything necessary to combat the White Plague among the Black Race it is the education of the colored physicians. I have no doubt there are some good physicians among them, but it has not been my fortune to meet many. The brains of most of them are childlike and they have no conception of the immense importance of this subject. In New York, of course, the colored people contract the disease because of bad housing, etc., but the majority of them are employed in hotels and restaurants. They work at night and have irregular hours, and when they are through they go to a dance hall or some place of that kind, for many of them are great sports. We must teach these people the value of a moral, simple and properly regulated life. As long as they do not lead simpler lives and imitate the white race in the matter of proper sanitary methods so long all our efforts to stamp out tuberculosis among them will be in vain. I think the problem is indeed a very serious one. The fact of our close contact with them must stimulate us to a warfare against tuberculosis among their race. Education, better housing, more regular living, temperance and better morals for the negro are the factors which will surely lead to some success.

Dr. Dunning S. Wilson, Louisville, Ky.: I have found, much to my surprise, that the factor of racial predisposition may be almost eliminated.

In Georgia, where the percentage of negro population is fifty-eight per cent., the death rate is about nine per cent.

In West Virginia, where the negro population is only about four per cent., the death rate is between thirteen and fifteen per cent.

In Kentucky, my own state, the death rate runs up to fifteen per cent. and the proportion of negroes there is low.

In Louisiana the death rate is comparatively high, but when we take into consideration the population of New Orleans, which leads in the death rate of tuberculosis, it is not so high.

As Dr. Knopf has said, a great deal of the trouble is due to ignorance in the South. I was much surprised to see in the report of the Board of Health of New Orleans that the reason given for not requiring registration was because a Dr. Mays, of Philadelphia, whose article was quoted at some length, was of the opinion that steps taken to relieve and stamp out tuberculosis resulted in increasing the prevalent mortality from pneumonia.

SOCIOLOGICAL SECTION

Dr. Charles L. Minor, Asheville: Vital statistics concerning the negro in the South are absolutely worthless; they are not worth the paper they are written on. All we know is that the death rate is enormous in the cities and low in the country.

In my experience no negro who develops tuberculosis ever recovers. If we cannot do preventive work, we might as well stop, for therapeutics after the disease develops is hopeless. Personally I believe in the survival of the fittest and I believe that this disease will settle the negro problem eventually. All preventive work depends upon the intelligence of the patient and until you can raise the level of negro intelligence the outlook must remain bad.

Even those of the race who are leaders are simple and childlike in their efforts, and until you can teach them those hygienic rules which are essential (and I have not yet seen them learn them), you will not have results.

EFFECTIVE METHODS OF EDUCATING THE PUBLIC

By Paul Kennaday
New York

Upon popular education we must ultimately rely for the prevention of tuberculosis. That the annual sacrifice of 150,000 persons in the country goes on year after year hardly unchecked and exciting no popular concern, that the conditions that make for tuberculosis have scarcely yet been touched, that for those suffering from this curable disease little or nothing has been done in vast sections of this country, and that it is not even attempted, in most communities, to control infection through this communicable disease shows an ignorance, an indifference and a greed that would overwhelm us had we not faith in the ultimate ability of men and women to do the rational and the right thing.

The education, then, that would make this preventable disease a prevented disease must teach men and women and by many and devious methods; somehow, some time, it must make it generally believed, as it is not now, that tuberculosis can be prevented and can be controlled. It must make men and women realize, the rich and poor, the employer and the wage-earner, what the conditions actually are and what remedies are needed. Men and women must be unwilling and unable to rent dark and loathsome tenements to those who cannot afford to pay for light and air. Labor must be so regulated that men and women shall be unwilling and unable to so employ little children and women as to jeopardize their health and undermine the wages of men; unsanitary conditions, the ever increasing speeding up of machinery that cast aside from the present industrial rush the laborer of 40 or 45 years to become an occasional worker or one of the unemployed, must be prevented by the conscience and the will of an enlightened public. The public's money must be expended for the care and segregation of

the sick, and the careless and ignorant and vicious consumptive must be controlled.

The prevention of tuberculosis, therefore, is part and parcel of every scheme for the improvement of conditions under which men live and work. Housing reform, child labor legislation, the regulation of women's work, factory acts, employers' liability acts, the suppression of the proprietary and patent medicine evil, small parks and large ones, the school, the trade union, the church, the organization of charity, whatever in fact helps to build up a sound body and a sound mind, helps indirectly and yet often forcibly to prevent tuberculosis. The plan of popular education in relation to tuberculosis which would ignore these correlated movements and which would refuse to ally itself with many of them would lose many opportunities for effective work.

But the prevention of tuberculosis must not be left to those movements which are only indirectly concerned with tuberculosis. Definite, active, enthusiastic organized work for the purpose of reducing the death rate from tuberculosis is needed and needed badly.

To carry out an effective plan of popular education and organization is essential, either a committee of some already existing organization in which the public has confidence, or a separate and independent society or committee. In every city in this country there should be a group of men and women associated together for the distinct purpose of educating the public in relation to tuberculosis, grouping themselves together on state lines and then into a national body for certain important parts of their work, so as to prevent waste of energy and to give unity of purpose to their general plan but working along local lines in order to arouse their fellow-townsmen to the serious nature of the problem that must be brought home to each individual citizen as a personal responsibility.

Intelligent self-interest and local civic pride must be appealed to rather than a general humanitarian desire to rid the state or the country of a disgrace that is too remote and too widespread to be felt as the business of any one in particular. The neighbor who has been seen and who may get tuberculosis or convey it to us, will arouse and sustain our interest far more readily than the citizens of another community who has not been seen and whose dangers, taxes and whose local pride are matters of little personal concern to others.

Such an organization formed of physicians and other men and

women who are well acquainted with some of the many questions directly connected with the problem of tuberculosis, no matter how interested they may be in the prevention of tuberculosis and no matter how disinterested their motives, if they are to do their most effective work, must have a secretary who will devote his time and, in cities of any magnitude, all of his time, to the executive work of the committee. Such an officer must tread the straight and narrow path that leadeth—between the ingrained conservatism of the medical profession and the popularization of a topic too long regarded as belonging exclusively within the realm of the laboratory and the sick room.

Conscious of the serious nature of the work in hand a committee so organized will be in a position to go along the line of least resistance and to take up as an important and principal part of its program, the education of the public to a proper realization of the fact that tuberculosis is a communicable and a preventable disease.

This part of the committee's activities will naturally separate itself into three divisions—lectures, publications, exhibitions.

Lectures.—It is through the lecture as a rule that the newly organized work for the prevention of tuberculosis is introduced to the public. The lecture is advertised by handbills and through the press, and a complete copy or a pretty full summary of the lecture is prepared for the reporters. The first lectures may be of a general character in that it will be useful to dwell upon the nature, the cause, the care and the prevention of tuberculosis; they may point to the need for organization, for coöperation, for more hospital facilities, for better administrative control, and in so doing they will be of some value in laying bare the facts of the case before the community. On the other hand, after these introductory and general lectures, the lecture on tuberculosis for those from among whose ranks are chiefly recruited the victims of tuberculosis must be a plain, homely talk on tuberculosis, the disease of the body, rather than a lecture on tuberculosis, the social problem. The physician who will not talk too learnedly and yet carries with him the prestige of his learning is always more readily listened to and believed than the layman, and it is well for the committee to secure as early in its career as possible promises from a number of competent physicians to do this important and often irksome work of public speaking.

To the layman who is alive to the need of popular education and to the need for measures that will root out the causes of tuberculosis, it

is difficult not to speak of these things almost to the exclusion of the medical aspects of the case, while the task is no easier for the physician to so combine the medical and social sides of the problem that his audience shall each one realize his duties and rights first as a person who may have tuberculosis, and secondly, as one who should demand protection from those conditions whether of homes, factory or administrative control that may expose him to tuberculosis.

Lectures should be illustrated with stereopticon views and where this is not practicable with photographs large enough to be seen by the audience when shown by the speaker from the platform. Photographs about 22" x 28" when mounted on canvas are convenient for this purpose and may be easily handled by the lecturer. Newspapers and magazines depend largely upon their pictures for their popularity; pictures have been found to pay, they are what the public want and they will draw an audience to a tuberculosis lecture just as they will sell a paper.

To the tired factory man or woman away for a few hours' relief from the care of a large family and from the noise and work of the tenement home, as to the man and woman in more prosperous circumstances, the prospect of listening to a talk on tuberculosis may not be anticipated with quite as much relish as we may experience in looking forward to the delivery of the lecture. We are not surprised, then, if tuberculosis does not appeal as a particular attraction for a social evening's entertainment and we soon learn that a certain amount of circumlocution is advisable in announcing the subject of the lecture just as we learn that another way to bring out an audience will be to announce speakers whom the public want to see and pictures and, even, refreshments.

How to secure the opportunity to deliver enough lectures is often a difficult problem. In New York this difficulty is partly overcome through the public school system of "free evening lectures for the people," which furnishes each year forty-five audiences, with a total attendance of over eight thousand persons, for illustrated lectures on tuberculosis. School buildings seem particularly appropriate places for such lectures and in most places can be used to much better advantage than they now are. Churches, and especially Catholic churches, are well adapted for this work, thought, except in Boston, little if anything has yet been done in the way of lectures in Catholic churches. The settlements compose another group where audiences may be ob-

tained, and women's clubs still another. But the trade unions, because of their number, their wide influence on the wage-earning class in general, the intelligence and energy of trade unionists, the close relation that occupation has to tuberculosis and the effect that tuberculosis has on union sick and death benefits present probably our best and strongest friends. However, it is a little difficult at times to get at them.

The best method of accomplishing this seems to be to seek and follow the advice of some few individuals prominently identified with the movement. Sometimes these leaders will extend an invitation to appear before the central body to which in most cities the unions send their delegates, sometimes they will advise sending circular letters offering lectures to the affiliated bodies themselves, or again they will invite a conference between a committee of their own and the tuberculosis committee. At last, in one way or another, they will usually show their willingness to join us in the struggle. They need only to be met half way. This they have shown in numerous instances and perhaps most notably at their recent twenty-fifth annual convention where the privilege of the floor was accorded to a representative of this National Association, his address and the report of the standing committee on tuberculosis at that time appointed being both printed in full in their daily bulletin, in their permanent record of the proceedings of the convention and in a special circular of which an edition of thirty-five thousand was printed and distributed throughout the unions of the country.

A word of warning in this connection may not be amiss; the unionist before whom we would appear is a man of brains, of action and of words. He will often talk back to a lecturer and it is well to be prepared with an answer for this typical argument which appeared some months ago in the official journal of the United Garment Workers.

> The problem of tuberculosis is first, last and all the time one of prevention and not one of cure. What profits it to try to cure a man, even to cure him, if we leave no other path open to him, if we drive him back in fact to those very conditions that brought on tuberculosis? We study our statistics of the relation of occupation to tuberculosis, and we see that there is a perfectly definite relation between certain occupations and tuberculosis; that where there is dirt and grime and dust, long hours, foul air and bad pay, the community pays for what it calls cheap prices by a little money and many lives sacrificed to greed, ignorance and indifference.
>
> We know that tuberculosis is preventable, we now have been told so long enough, let us then prevent it. Let us of organized labor unite with those who have organized this movement for the prevention of tuberculosis, and when we

say that a man should not work for more than eight hours let us base our claims among other things, upon these very things that these gentlemen of the medical profession have been solicitous to teach us. They say that the prevention of tuberculosis is dependent upon a general appreciation of the value of fresh air, good food and temperate living. Very well, let us tell them that to get fresh air into our shops means factory legislation and more inspectors to enforce the factory laws, that good food costs money and can be had only with good wages that temperate living comes only when a man is not driven to excess by despair for the future of his children and by despondency over the dead monotony of the precise mechanical toil which returns to him only so much that he may live to feed his machine another day!

Gentlemen of the tuberculosis committee, you ask us to co-operate with you. We are here, ready and stretching out our hands to you. But they are the hands of men who have toiled, who need not study over records to know that tuberculosis is the great enemy of the printer, the marble polisher, the cigarmaker, the clothing worker. They are the hands of men who have seen their fellow workers fall victim to this disease, which you assure us is a preventable disease, of men who month by month and year by year are paying out their hard-earned dollars for the brother sick of this disease, or to the widow left penniless by the untimely death of her husband. We know what tuberculosis is. When we decide that in order to live properly and bring up our children decently we must have shorter hours or more pay in this day of advancing prices and increasing rent, do you gentlemen of the medical profession and all of you of the organized movement for the prevention of tuberculosis give us your support, or at least condemn us not without a hearing. Because some labor leaders are corrupted by high financiers, do not say that all have their price; because there are doctors who are shysters we do not refuse to believe in the medical fraternity as a whole. The quack, the sure-cure man, the man with the germ-killing gas and the strength-giving preparation, flourishes in proportion as you convince people that tuberculosis is curable; so does the selfish, unscrupulous labor leader fatten on organized labor—in rare instance and in stated cases.

You wish to prevent tuberculosis, you recognize that you must get at the causes. If you cannot learn from what we of our personal knowledge can tell you, study again and more thoroughly your statistics and then come to us convinced. Remember that there are three million organized men in this country and that millions more of unorganized men reap the benefits that the union must fight and suffer for.

Prevention, organization, co-operation. With co-operation between organized labor and organized philanthropy we may look forward with confidence to the prevention of this preventable disease. Without co-operation, prevention may come, but how much later; at the price of how many tens of thousands of lives!

You men and women of the organized movement for the prevention of tuberculosis are, we believe, in earnest; you have a message of hope and of deliverance for us. Let us hear them; let our members learn from an authoritative source that this disease, which so many think is inevitable, is nothing of the kind; that tuberculosis reaps its grim harvest among us only because we have left the field of waste, untilled, uncultivated by the seeds of knowledge.

Fellow unionists, awake and show a determination to push to a successful conclusion the great work of stamping out tuberculosis as a world scourge.

The amount of correspondence coming before trade unions at their regular meetings is often large. Letters are read in open meeting, sometimes none too well and none too clearly, and if the members are then to hear and understand them, communications should be as brief and as much to the point as possible. It is well in the case of unions and others to accompany letters seeking opportunities to lecture or to distribute circulars with return addressed postal cards having question plainly printed with spaces left for brief replies. In dealing with unions, if not at other times, the union label should be used on all printed matter, else often scant courtesy will be given to invitations and to circulars.

Just as we seek to educate trade unionists, so we will approach school teachers as a more or less distinct group, women's clubs, fraternal organizations, negroes, church clubs, ministers and physicians, having in mind that the education of the public is a pretty large and somewhat vague undertaking which needs to be reduced to something certain and tangible. Our large and unwieldy public thus is reduced to a small number of distinct groups having each a certain group consciousness which may be appealed to for sustained support to our movement. All of these groups and many others need educating in one way or another, even the physician and worker in organized charity and that small body of the elect, the secretaries of anti-tuberculosis committees. Perhaps it is but cumulative evidence of my own ample fitness for membership in one of these classes that requires more knowledge for me to testify here that it is my information and belief that a considerable part of the medical profession fails to appreciate the value of administrative control of tuberculosis, and needs to take more concern in relation to the available and practicable methods for the relief of individual consumptives. It is not uncommon, for instance, for physicians to recommend "the west" or "the country" to the poor city consumptive as unable to support himself in the one place as he is unfitted to maintain himself in the other. With such advice the consumptive returns despondent to his city home not knowing or neglecting the method of living that even there he may follow with good results, or he lands exhausted and nearly penniless in a strange land to learn too late that the cure of consumption requires food for the stomach as well as air for the lungs, that too many others willing to work for a pittance have preceded him and that for his own scant physical powers there is little if any demand. Alone, far from home, relatives and

friends he must cast himself upon the charity of an already overburdened public. The physicians of the country in this matter might lead public opinion in the right direction if they would do their part to prevent this useless suffering and this unfair imposition upon such states as Colorado, California and Arizona. To this end they might well follow the suggestion mailed to every physician in New York City by the New York Tuberculosis Committee to the effect that persons suffering from tuberculosis should not be sent to other states unless:

(*a*) They are physically able to work and have secured in advance a definite assurance of the opportunity to perform work of a proper character at wages sufficient for their suitable support; or,

(*b*) Unless they have at their disposal at least $250 in addition to railroad fare.

Publications.—In preparing printed matter an association will bear in mind the same thought that has influenced it in its lectures, that the public which is to be educated is composed of certain well defined groups whose attention is to be attracted in different ways and whose motives for becoming interested in tuberculosis may be quite dissimilar. Thus, your educated man may be persuaded to sit down and read the more or less elaborate pamphlets on the prevalence and prevention of tuberculosis into which form the committee may preserve some of the lectures delivered under its auspices. Often such pamphlets, too, may be used as a basis for appeals for financial assistance to the work in hand. All such publications should be issued with covers and should avoid the appearance of cheapness. For a few such general pamphlets, for reports of investigation carried on by a committee, and for careful studies, such as those of Miss Brandt on the Social Aspects of Tuberculosis, there is of course a very real use and there will always be many grateful and appreciative readers, but for the printed matter of the more common sort, the occasional pamphlet or the circular issued by all associations, these should be directed more particularly than is usually done to particular groups, to school teachers, physicians, ministers, women's clubs, etc., or they should be on certain subjects, such as sanatoria, ventilation, the cleaning of public buildings and private houses, etc. Always the committee or association should print with the distinct purpose of relating tuberculosis to matters that are already of especial interest to certain large groups or in order to point out the relation of particular and common practices to tuberculosis,

bearing in mind that tuberculosis, *per se,* does not very much interest the laity. Peculiar difficulty is presented by the circular or leaflet for the use of the great mass of wage earners to whom, above all others, tuberculosis and conditions and habits that make for tuberculosis, are matters of personal concern. In New York City we have printed in English, Italian, Yiddish, German, and Bohemian, a circular of information which it may be worth while to consider in detail:

(1) It is printed on cardboard, and thus is much less likely to be thrown away or destroyed or to become torn than if it were printed on paper. (2) It is of a size (4 in. by 6 in.) convenient for the pocket. (3) The cover contains a title designed to attract attention and to excite curiosity as to the rest of the card—Don't give consumption to others; don't let others give it to you. (4) The names of the committees issuing the card, also printed upon the front cover—the Committee on the Prevention of Tuberculosis of the Charity Organization Society, and the Committee on Sanitation of the Central Federated Union, are such as to induce public confidence in the statements contained in the card. (5) The trade union label is affixed to the cover, as without this our protestations of coöperation with our union friends would go for naught, and the circular itself would go unread by unionists, men and women. (6) It it accurate. (7) It is brief. (8) Its phraseology is simple—throughout "consumption" is used rather than "tuberculosis," "germs of consumption" and not "tubercle bacilli," "spit" and not "expectorate," and even "don't" instead of "do not." (9) It is printed in large type. (10) The first page, in sixteen very short sentences tells "How to prevent consumption," and the second page, in like manner, tells "How to cure consumption." (11) The fourth page, the back cover, contains a list of our nine special clinics for the treatment of tuberculosis, giving the names, addresses and the hours at which they are open. (12) Throughout this card the emphasis is laid on fresh air, good food and temperate living as means both for the prevention and cure of tuberculosis. (13) A special warning is given that the careful and clean consumptive is not a dangerous person with whom to live and work. (14) The advice presented is homely and practical, such as can be followed by the average wage-earner open to the allurements of the nostrum seller and unable for the most part to leave his work or to remove from his crowded rooms.

Every one of these points seems essential to a successful popular leaflet on tuberculosis.

The press of the country, the daily and weekly newspapers, the magazines, the medical journals, *Out Door Life* and *Charities and the Commons,* are excellent mediums for articles about tuberculosis, and they are mediums which we do not sufficiently use.

Probably tuberculosis committees could obtain many more readers than they now have for their more lengthy and elaborated articles on tuberculosis if they would supply these articles in the first place to some one local newspaper. The more sensational the newspaper and the more sympathetic its tone for the wage-earner, whether or not we may doubt the sincerity of its attitude, the more is that paper going to be read by those whom especially we want to reach. We should hide our scruples if we have any and gladly accept the opportunity presented. Editors will testify that tuberculosis now has the public's attention and many a reporter could make good copy out of material hidden away in the offices of our anti-tuberculosis associations. Give the reporter what he wants and what the public wants, a story, something with the personal, human element and he will often add what he looks upon as dry-as-dust, but what to us and to some readers may be considered as the kernel of the whole matter. At any rate, the article or the few lines set a few more people to thinking about tuberculosis, and their next step, that of thinking right, will be the sooner taken. There are a large number of trade union papers published in this country, weeklies and monthlies, which are read from cover to cover by thousands of men. Their supply of copy is often limited and they will gladly print much more about tuberculosis than they are now supplied with.

Exhibitions.—Elementary as the advice may be made in relation to tuberculosis yet it may not be understood, and if understood, it is often soon forgotten or neglected. Partly to make the lesson taught more striking, partly to attract the attention of more people, this year a new method of propaganda has been followed in a number of cities. This is the tuberculosis exhibition. A few other places have or are preparing to have these local "peripatetic lung shows" as they have been called, but the scheme is new enough and seems good enough to warrant a detailed description of the Travelling Tuberculosis Exhibition as we have it in New York. Taking our cue from the American Exhibition held at New York jointly by this National Association and

the committee of the New York Charity Organization Society, and subsequently sent by the National Association to a large number of other cities, we, in New York, have collected a considerable number of photographs, charts, models and some few pathological specimens and have advertised the fact that we have a travelling tuberculosis exhibition which we are prepared to set up in congested tenement house sections of the city.

From the responses received we have, since January of this year, arranged a schedule consisting of exhibitions in New York City at four settlements, two churches, one public library and one college museum. Our itinerary has been unbroken from January 15, when the first of these exhibitions was given, up to the present time. Our schedule will carry us up to June 15 of this year and there will be a resumption of the same work in September, with the end not yet in sight.

Our material was taken principally from New York, with just enough other exhibits to give a little variety and to emphasize some particular points. For the most part the 249 frames of photographs, etc., the thirteen models and the ten pathological specimens were loaned to us, though some of the models were made for us at our own expense. These photographs we then had mounted; about one-half we had on 22″ x 28″ grey cardboards and framed with the light wooden frames made for the familiar exhibition cabinets of which the Department of Health and the Charity Organization Society gave to us a large number. We took these frames out of their cabinets, although they could have been thus shown with much less trouble, because we believed that these cabinets, however useful and convenient they may be for some purposes, are of very little value for popular exhibitions such as these, where the average visitor is at first only so slightly interested in the subject that the difference between looking at a picture hanging on the walls and opening a cabinet, is enough to lead him to examine the one and to pass the other by unheeded.

With the amount of material that is shown, ease and rapidity of handling becomes all important, and therefore these frames are fitted with screw hooks top and bottom so that they can be quickly hung one from the other, three or four in a line, without the delay and bother of wires. These pictures, too, being without glass may be put into boxes one on top of the other without fear of breakage. Boxes with hinged covers and grooves to hold the glassed pictures in place

were made and numbered to correspond with the numbers on the pictures, so that they can be packed, shipped from place to place, and unpacked without fear of breakage, with no unnecessary delay and without the driving of a single unnecessary nail. The models of tents, lean-tos, tenement blocks, etc., are also transported in specially constructed boxes. These boxes, piled one on the other and covered with burlap for each exhibition, serve as excellent stands for models and save us the expense and bother of providing and transporting other stands and, not unimportant items, we thus do not tax the limited storage place available at the exhibition halls and at the same time we keep our material away from the predatory hands of unknown and unseen janitors.

The manual labor necessary for the installation of the exhibits is thus reduced to the simplest form. But this setting up of the exhibits is but a small part of the work necessary in connection with each exhibition. After the arrangement of the definite preliminary itinerary, the substitution of other exhibition places for those which have dropped out, and perhaps the complete rearrangement of the whole schedule, it is time to hold a series of conferences, about a month in advance of each exhibition, when the coöperation is sought of the local physicians, settlement workers, school teachers, clergymen and generally of all those who are identified with the social work of the particular neighborhood in which the exhibition is to be held—after this a schedule is arranged for the attendance from ten o'clock in the morning until ten o'clock in the evening of persons competent to explain in turn to small groups of people the meaning of the different exhibits and the purpose of the exhibition—physicians and nurses are usually asked to do this part of the work, those from the region in which the exhibition is to be held being called upon as far as possible, each member of the group selected for the demonstration of each exhibition being asked to volunteer for three periods of two hours each. The Board of Health in New York City, in addition to loaning much exhibition material and department wagons for moving the exhibition from place to place, has regularly assigned two physicians for the instruction of the school children at these exhibitions, and thus the task has been much lightened of obtaining volunteer instructors in sufficient number to be on hand eight and more hours a day for an almost unbroken period of five months. While these arrangements are being completed other details are also being attended to. Lectures to be illustrated with the stereopticon lan-

tern have been arranged for, usually not less than seven being scheduled for each exhibition, about one-half of these being in the language of the foreigners settled in large numbers in the districts where the exhibitions are to be held.

The proper advertising of each exhibition is important. Articles for the newspapers are sent to all the dailies just before the opening day. Copy is prepared and proof corrected by the Committee, as a rule, for the various sets of handbills and 22″ x 28″ card board posters which are used for each exhibition. On an average two hundred posters will be placed in shop windows and on elevated railroad stations and forty thousand of the handbills will be distributed, these last usually being printed in two or more sets, one lot in English, the other in Italian, Yiddish or German, depending on the nationality of the neighborhood. Handbills and posters alike have printed upon them four large circles showing in diagrammatic form the relation of tuberculosis to other diseases. The diagrams can hardly be understood by the majority of persons who see the circles, but they attract attention and thus serve their purpose of advertising the exhibition. The schools, dispensaries, hospitals, churches and those men, women and children regularly attending the house where the exhibition is held are used as distributing agents for these advertisements.

Each neighborhood house attends to the local advertising and pays all printers' bills therefor, and, in general, after the necessary preliminary arrangements have been made by the committee, the responsibility for running the exhibition is assumed by such house, the Committee of course keeping in constant touch with the work.

The exhibitions are each set up in two days and a half by our regular office force working with the help of two young men, college students or clerks looking for occasional employment. The same material is knocked down and made ready for the trucks supplied to us by the Board of Health in an hour and a half. The initial cost of equipment was about $350, extra services and supplies for each moving cost about $15, while for printed matter distributed at the exhibitions, principally the cardboard folders of instructions and the programs, there has been expended all told about $400. The settlements and others managing the separate exhibitions have spent on an average about $50 each for advertising through handbills and posters and about half as much again for extra janitor services and light, 230,000 copies of these advertisements having thus far been distributed in the city.

The exhibits are divided into three classes as shown more particularly by the pour-page programs which are liberally distributed at all the exhibition halls. The first division reads "tuberculosis is a preventable disease," and here we have the principal part of the Board of Health exhibits, a large chart showing the reduction of the death rate from tuberculosis in New York City from 4.28 in 1881 to 2.47 in 1905, a series of printed instructions for consumptives and those living with them, and diagrams and photographs illustrating generally the educational and preventive work carried on by the Department. The work of the National Consumers' League, of the City Tenement House Department, the State Factory Department, and of the Tenement House Committee and the Committee on the Prevention of Tuberculosis of the Charity Organization Society are shown here by models, photographs and diagrams.

Under the second division, "tuberculosis is a communicable disease," is a collection of nine human lungs, showing the healthy lung, the normal city lung pretty well spotted with dust and dirt, and lungs showing the process of healing and in various stages of disease. As a part of the pathological exhibit and placed around these specimens of lungs, are the Board of Health signs prohibiting spitting, diagrams and photographs illustrating the method of infection through spitting and coughing, and an exhibit of the right and wrong way to sweep and clean. To still further enforce the practical value of this division of the exhibition there are distributed at this point simple instructions in relation to sweeping and dusting, printed on small cardboards in English on one side and on the reverse side in Yiddish, Italian, German or Bohemian.

The third and last division of the exhibits is "tuberculosis is a curable disease," under which comes the illustration by means of photographs and models of the work of all of our city tuberculous hospitals and special tuberculosis dispensaries. Here in the same way are shown models of the Sea Breeze Hospital for Children, of the Lean-tos from Loomis, of the White Haven Shacks, and photographs from the Adirondack Cottage Sanatorium, from the Boston Day Camp and from a number of other places outside of New York City. The exhibits are all plainly labeled and throughout the attempt it made to make the lesson so plain that it will be readily understood by all, while lectures and demonstrations alike try to make of practical application

to the average man the graphic representation of tuberculosis preventable, communicable and curable.

On the whole the attendance at these exhibitions has been most satisfactory, running from 4,500 in the smaller exhibition halls to 49,000 in three weeks at the Educational Alliance, a large Hebrew educational and social betterment institution in the congested lower East Side. In the four months that we have now been running these exhibitions, there has been a total attendance of something over 80,000 persons.

For the most part those who have attended the exhibitions have seemed much interested. The most promising single feature of the scheme has been the intelligent interest shown by the children of twelve years of age and upwards who have been sent to the exhibitions in charge of their school teachers by their school principals as a regular part of their school work. For the instruction of these children the Department of Health has regularly assigned two Department physicians who in a plain, simple and practical manner explain the exhibits to the children and answer their many questions. In teaching the children we, as well as they, have learned an important lesson and in our next season we hope to apply ourselves more particularly to the schools, using the school building themselves for exhibition halls, if the consent of the Department of Education can be secured. For it almost seems that in the school child lies our chief hope for preventing tuberculosis. We must teach this child what tuberculosis is and how to prevent it and not wait until our task comes to be a case of curing a father or mother. A determined and sustained effort should be made to induce our school authorities to devote more time to regular instruction in regard to tuberculosis. The French scheme is a good one of using the paper covers of school books for printed instructions in relation to tuberculosis. Something of the same sort is done in Newport, where short leaflets on tuberculosis are pasted inside of school books, and by the City of New York where last year pasters in relation to spitting were distributed to the public schools to be put in school books. By the proper ventilation and cleaning of class rooms, educational work of a high order could also be done among the children if our school boards could first be taught to properly ventilate and clean class rooms.

As the plain talk, face to face and man to man, is of more value than the printed page, so is the exhibition superior to the spoken word.

It drives the lesson home as nothing can but the sanatorium and the dispensary and it is even superior to these in that it is a direct appeal not only to the sick, but to the well. It is to be remembered, too, that this is not merely the substitution of a new method of educating the public; it makes full use of the old methods, while at the same time it adds something distinct and superior to these. Ten lectures may thus be delivered where before there was difficulty in securing an audience for one, thousands upon thousands of circulars are distributed where formerly but a few hundred could be placed. A whole neighborhood is set to talking and thinking about tuberculosis.

The Board of Health, the physician, the nurse, the charitable visitor, the hospital and the dispensary are each one of very great service in teaching the public and are each an essential part of any comprehensive and effective scheme of popular education in relation to tuberculosis, but their work in this direction is of a peculiar character, which do not seem to come properly within the scope of this paper.

There can be little doubt but that the situation demands more energy, more determination and more money than are as yet being used to meet it. It is a false economy to distribute circulars, for instance, as is usually done, a few here and there, perhaps one to every one hundred of the population, and to repeat this the next year with another group of persons. If it is going to be worth while to lecture or to print for these groups next year, it is more worth while to do these things this year. And then to do it all over again next year. In placing printed matter, as in the other educational work, our goal should be each year to leave as few parts of the city as possible untouched and waiting for our next year's campaign. Only the ability to place properly and to distribute carefully our circulars should limit the number we print, and not the question of cost. It is cheaper in lives, and, in the end, in money, to do the work on a large scale.

DISCUSSION ON MR. KENNADAY'S PAPER

Dr. John H. Lowman, Cleveland: I cannot express my commendation of this paper in terms strong enough. It seems to me that the speaker has gotten at the very root of the whole matter. Were I to express my own ideas on the best way of reaching the people I would use many of the statements embodied in this paper. It is necessary for us to come in close contact with individuals and to use every

means in our power to concentrate our influence for their benefit. It is the workman—the laborer and his family—that suffer and they cannot be reached from the rostrum, nor yet always by the printing press. They must be personally approached. Although this at first may seem difficult it is not in reality so, if one works through the societies which exist among the people, and which already have their confidence and their support. Beside the societies having a purely economic significance, there are numerous national societies among our emigrant population, and these societies can reach and instruct their adherents with a degree of effectiveness which would be impossible to us.

Almost all national societies among workmen are organized for a special purpose—the assistance, protection, elevation or amusement of their members—but it can be easily proven and will be immediately apparent, in fact, that all these organizations can be re-specialized from the point of view of tuberculosis, and thus be shown to have one field of action common to them all. I have found these people eagerly anxious for information and help, and their leaders enthusiastic and able. They all want to know what they can do in this matter which affects them so closely.

In Cleveland there are 100,000 Slavs. They are organized into many societies, but there are a few men to whom they specially look for guidance. We have, therefore, worked through these men: some of them are on the directorate of the Tuberculosis League. They have published information in their national papers, distributed pamphlets, organized lectures and in this way have done much to spread knowledge concerning tuberculosis.

The Finnish community numbers about 8,000. They can be approached in the same way. The Italians, about 30,000 in number, are similarly accessible—and the Jews, who are rapidly increasing, are well organized and their organization is very effective.

The colored population is similarly guided and controlled through its churches and through its Business Men's League. This latter represents the business and professional colored men of the city and has shown itself most generous and intelligent. As a mark of its appreciation of the work done in the homes of the colored people by the Visiting Nurse Association it voluntarily proposed to help contribute a nurse's salary to the association. As all the district nurses are alert on the tuberculosis question, this colored club becomes in this way a supporter of the tuberculosis movement. It will in time organize lec-

tures and distribute leaflets of information and support the movement through its local press.

I cannot express too strongly my belief that it is by taking advantage of organizations already at work and by securing the co-operation of the national leaders that we will most effectively reach the people.

The labor unions and mutual insurance and benefit societies can and should be approached in the same way as the other societies. All these organizations give a great deal of money in weekly benefits to their members who are ill with tuberculosis.

Many of the unions have no accurate accounts and are not aware of the demands made upon them by tuberculosis. The mere request for statistics from them has aroused an interest in the question, and an increased effort for greater accuracy, and when this request has been followed by a distribution of leaflets and by lectures, thousands of people have been directly reached.

On account of the statistics being so imperfect, it is impossible to tell what proportion of sickness among the unions, sokols and benefit societies is due to tuberculosis.

Still another way of reaching the people is through the children.

In November, 1905, a children's and family clinic was established in connection with the Tuberculosis Dispensary in Cleveland. The object of this clinic is the examination of all children living in tuberculous families. The clinic has been open Saturday afternoons only. Since it was opened 300 children have been examined: eight per cent. of them have been found to be tuberculous and ten per cent. suspicious. Thus 18 to 20 per cent. of the children from families where there is tuberculosis require careful supervision. The effect of such supervision on the sixty families represented by the children who attend this clinic is profound. In order to supplement this work a certain definite district of this city—a school district—was selected and a house to house visitation made. In this group chosen there are 1,420 families. Five hundred of these families have already been visited and 125 cases of tuberculosis found. Four hundred children were found living in these infected families and consequently exposed to contagion. If we accept our dispensary figures, that 20 per cent. of the children living in infected houses have tuberculosis or are suspect, one sees that there are eighty children in one school district requiring active supervision. The visitation of this particular school district was done ostensibly to find those children that most needed a summer outing.

Incidentally the inspectors spread information about tuberculosis and this could easily be done because the invalids usually had no medical advisors. The children were recommended to the children's clinic of the tuberculosis dispensary and then to the fresh air committees.

This work of investigation has brought the question home to the very people who most need to know about it. More actual instruction has been accomplished by this means than by any other.

Every agitation of this question is useful and all means of awakening the public should be used, but the direct individual method through the peoples' clubs and unions is certain to yield widespread results.

The obligations of the states and municipalities have been made clear on many occasions. They should enforce compulsory notification of tuberculosis, establish laboratories for the examination of sputum, provide hospitals and sanatoria for the care and cure of the sick. These are the large important works the development of which calls for public aid. But in order that these measures be sustained or even inaugurated or their importance recognized, the people must be individually and collectively seen and instructed. And this, it seems to me, is best done through the benevolent, educational and charitable societies already organized and active.

It is surprising to find how much is unconsciously done for the tuberculous and how much money is spent on them and on this disease without the societies themselves being aware of the fact. Even in communities where the city maintains, at great expense, a sanatorium the expenditures of private benevolences will surpass those of the city. This is the case in Cleveland. Last year the municipality spent $35,000 for the relief of tuberculosis and the private benevolences spent $40,000. Thus $75,000 was expended on account of tuberculosis in one year, and this does not include moneys paid by the insurance societies or by individual charity. When one realizes that the people are ready to give $75,000 ($40,000 of which is a private benevolence) he sees what a great opportunity there is for co-operative work. Certainly the disease can be checked if this amount can be annually drawn upon in a community.

I wish to emphasize again the fact that we cannot afford to be loose or diffuse in our methods of reaching the public. A commercial enterprise having large capital to "back" its advertising may risk reaching an enormous number of people with printed matter without any peculiar need to specialize its message, but this mode of advertising, if it is

to be successful, must reach these same people repeatedly and with varying and striking methods.

The scientific body must use different means. It must put forth an effort of individuals and combinations of individuals that will offset its lack of financial resource.

The very best of all methods then is to reach groups of people through their natural leaders and in ways familiar to them.

The plants already at work must specialize their power with regard to tuberculosis if knowledge concerning that disease is to be quickly and effectively disseminated.

We must study our towns and cities closely and lay hold of their economic and racial structure before we are really prepared to make a successful propaganda.

When we have examined into the chief industries of a place we must also examine into the societies, the unions, the groups of individuals that constitute the defense of the working people. These societies, unions, clubs and other combinations of men will give a very real support to any idea that can be proved to be of value to their organizations. And it would be well worth our while to make a profound study of the best way in which to bring this matter before them.

In all communities great and small men will group themselves together for protection, for instruction and for amusement. And it is precisely this grouping, this association of enterprise and effort that offers us the most complete method of effectively reaching masses of individuals who otherwise would remain unresponsive.

Edwin D. Solenberger, Minneapolis: Mr. Kennaday has given us a most excellent and practical paper on the important subject of educating the public. Instead of discussing what has been so well said, I wish to describe briefly some of the educational methods used by the Anti-Tuberculosis Committee of the Minneapolis Associated Charities. Our committee seeks to educate persons having tuberculosis and those living or working with them in the means of prevention and the essential facts concerning the cure and treatment of the disease. The committee employs a visiting nurse whose entire time is given to visiting, caring for and instructing indigent persons infected with tuberculosis. We find that the influence of the nurse on the educational side alone is far reaching and permanent. We have found great educational value in the instruction given at our various free dispensaries and clinics for

tuberculosis patients. The coöperation of the visiting nurses by attendance at these dispensaries and subsequent care and instruction in the homes of the dispensary patients has been of the greatest help.

The committee puts equal emphasis upon its effort to make clear to everyone in the community the necessity for concerted action by the state, the municipality, the medical profession, charitable agencies and private citizens. I do not know that we have used any unusual or unique methods to accomplish the desired ends. We prepared one attractive four-page circular, which was mailed to what we call our "blue book" mailing list. This circular therefore reached the more responsible and public spirited of our citizens—those most likely to be in position to help in various ways. This circular asked for interest and coöperation rather than for money, though the need for both public and private funds was pointed out.

Another circular was prepared containing a terse statement of the main facts in regard to tuberculosis, the method of treatment, and a directory of the various agencies in the city designed to provide medical and other assistance. This circular was distributed very carefully through many different channels.

A special four-page circular was prepared for use in the public schools and distributed by authority of the Board of Education. On a given day each pupil in the public schools of the city received one of these circulars in an envelope. Under the direction of the Superintendent of Schools the teachers gave a short talk in regard to the reason for the distribution of the circulars and asked the children to carry them home to their parents. The envelope stated that the pupil was requested by the Board of Education to take the circular home. We found that the children obeyed this injunction and we believe that the educational result of this effort was excellent.

Our Public Library, with a view to placing accurate information in regard to the subject of tuberculosis and its prevention within the reach of everyone, has filled a special section with literature on the subject. This section has been given a prominent place in the library.

We have made some efforts in the direction of reaching people through the churches. We had a neat single leaf circular prepared, adapting the size to the church bulletins which are given out in many churches by the ushers at the morning service. As these leaflets were folded with the bulletins they were given out by the ushers and fre-

quently the pastors made a short explanation of the work of our committee.

In our educational work we have been greatly aided by the newspapers of Minneapolis. The chairman of our special committee on publicity arranged to have articles appear in the daily papers at frequent intervals on various phases of the general subject of tuberculosis. These articles were usually written by doctors, but always appeared in the papers unsigned.

In our great task we ought to be able to learn valuable lessons from successful advertisers, practical teachers and educational psychologists. The coöperation of private citizens and effective action by the state, municipality and national governments all wait upon a thorough education of the general public.

Alexander M. Wilson, Boston: Our work with labor unions began with securing permission to speak in the Central Labor Union and gaining its endorsement of our plan to address local unions. We send one of our lecturers to a local union at its regular meeting, having previously arranged that he is to have the floor for a half hour talk on tuberculosis. The physician lecturing usually carries with him a few charts for illustration and in a very few cases a lantern slide demonstration is given, although in general the audiences are too small to make the outlay for a lantern justifiable. In our work in the churches the case is different, particularly in the Catholic churches where our audiences have in several instances numbered 1,000 persons. Here it is distinctly worth while to use the lantern.

Our experience with Tuberculosis Exhibitions may be of some interest. We began with a small exhibit in connection with a fair in Mechanics Building in October, 1904, and soon after we asked the Legislature for an appropriation to the State Board of Health to enable it to hold a more comprehensive exhibition. The appropriation became available in time to secure the National Exhibition in January of this year. The success of this exhibition and its influence on the various state departments and on the general public were largely due to the participation of the State Board of Health. At the close of the exhibition the Boston Tuberculosis Association secured duplicates of enough material for a small travelling exhibit which has been sent to different parts of Boston and to many of the cities of the State. Usually exhibits in these outside cities have been under the auspices of the local boards of health and their success depends largely on the interest and enthusiasm

of the men immediately in charge and upon the manner it is advertised. In Lowell, for instance, there was an attendance of 12,000 in one week, the city government having made an appropriation of $300 which was largely used in effective advertising.

Dr. Oscar H. Rogers, Yonkers, N. Y.: We have been making use of all the means that have so far been mentioned for disseminating knowledge on this subject among the people, and have recently put into operation in our city one more, which may be of interest to those here present.

The difficulty seems to be to overcome the inertia, the lack of interest, of the mass of the people, until they themselves have been attacked with the disease. We have in Yonkers a rapidly growing and cosmopolitan city. Its congested areas are so situated that the natural shopping district to which all the people come is the old village, and here on every pleasant evening, large numbers of working people congregate. For a number of years past, an advertising lantern exhibition has been carried on in the public square, but was finally discontinued through the action of the authorities, because of the obstruction to traffic. The Sanitary League has secured the use of this plant, and has been carrying on a similar lantern exhibition of instruction in tuberculosis. Through the board of education, we secured a large collection of pictures of scenery, of works of art, etc., and we run these alternately with slides containing tuberculosis aphorisms. We run the lantern three nights each week and at a cost of somewhere in the neighborhood of one dollar a night. The exhibition does not attract as large audiences as those brought together by the moving pictures of the advertiser, but still we get fair audiences. I believe that we are reaching a class of people that cannot be reached in any other way. If we had money enough to run a vitascope exhibition alternately with our tuberculosis slides, I have no doubt that we could reach many more people.

The plan is well worth trying in any community where there is a natural centre to which the laboring classes come. The lantern screen should be large—say 18 by 20 feet. Each slide should contain some simple, easily understood statement, such as: "If you have consumption, don't give it to others by spitting. If you have not, don't let others give it to you." "Don't spit on floors. Don't spit in corners of rooms. You may have consumption and not know it," etc.

We make use of about forty slides and are able to run them from two to three times in the hour during which the exhibition lasts. I

should recommend the adoption of this method in other cities, and should be very glad to be of service to any one who cares to give it a trial.

Mr. S. H. Adams, New York: As to the newspaper phase of the subject I have, in my work, sounded the sentiment of the newspaper people and found the editors very ready to give their columns to the consideration of public health matters. I think but few of the associations have made the use of the papers they might have done. Circulars, while valuable in their way, are apt to interest those only who are already affected. The newspapers reach all classes, and the sensational dailies in particular go to many who are ready to believe anything they read in the paper. The patent medicine people realize this very fully and take advantage of it.

Dr. Dunning S. Wilson, Louisville, Ky.: The association in our State has recognized the importance of the newspaper element and it has helped us from the start.

We have made the editor of one of our dailies chairman of the Publicity Committee, with other editors composing the Committee.

I think in this way we have accomplished a great deal of good. Editorials have been written, and in every way the different phases of the crusade have been carried out. I think these editorials and the position taken by the editors themselves should make us feel very much encouraged.

H. Wirt Steele, Baltimore: While in Maryland we have tried practically all of the methods that have been suggested it seems to me that not enough emphasis has been laid upon the importance of the use of the district nurse, the nurse for visiting tuberculosis patients. She soon becomes known in the community as a tuberculosis nurse and as she leaves instruction with individual families the knowledge spreads all over the neighborhood. In Baltimore we now have three of these nurses and I think the educational value to the community can not be over estimated. It has helped in a great measure too to allay phthisiphobia.

Dr. Thomas Darlington, New York: I think Dr. Roger's suggestion a very valuable one and will try it in the parks of New York. So far as the newspapers are concerned they take more interest in the matter outside the city than they do in New York. The only thing you can get into a newspaper there is a criticism of a public official or an insurance company. There is too much news there.

Surgeon-General Walter Wyman, Washington: I think it is due this association, and will be of interest, to narrate the results of a resolution passed at the meeting held in Washington one year ago.

This resolution, after reciting the good results of the national sanatoria for the treatment of tuberculosis patients established by the Army, the Navy, and the Public Health and Marine-Hospital Service, recommended to the chief executive of the nation the desirability of an inquiry through proper officers of the government as to the sanitary conditions existing in all government offices and workshops where a large number of persons are employed, especially with a view of recommending, if necessary, measures for the prevention of tuberculosis therein.

In November last the resolution was forwarded to President Roosevelt by Dr. Livingston Farrand, the executive secretary of our association, and the matter referred by the President to the Surgeon-General of the Public Health and Marine-Hospital Service for report, and on December 7, 1905, an executive order was issued reciting the resolution of the association and appointing the surgeons-general of the Army, Navy, and Public Health and Marine-Hospital Service a committee to prepare and submit to the President for approval a plan for carrying out the intent of the above resolution, empowering this committee to detail officers from each of the services named for the purpose of assisting in the formation of a plan for investigation and action.

A board of three medical officers, was thereupon appointed by the committee of the surgeons-general, one officer from each service. Written instructions were issued to this board, narrating the scope of the investigations and executive action contemplated, directing them to carefully consider and report upon the measures which seemed necessary and proper to carry out the intent of the resolution. The report of this board, going into many necessary details and giving good reasons for certain limitations in the work to be undertaken, formed the basis of the formal report to the President made by the committee consisting of the three surgeons-general.

The President promptly issued a second executive order February 28, 1906, containing the necessary directions for immediate action toward the desired end.

The two executive orders of President Roosevelt are printed in the pamphlet which I submit herewith, entitled "Prevention of Tuberculosis Among Government Employes."

While the extent and methods of the government in this great work

are indicated in the executive order of February 28, there are some features relating to administrative details which I believe it will be of interest to explain.

This executive order of February 28, 1906, relates first to persons and second to buildings.

1. *With Regard to Persons.*—Each executive department is to ascertain the names of persons in its service afflicted with tuberculosis, and to present to them the printed rules prescribed for their observance. Non-observance of said rules is considered a cause for separation from the service.

The three rules which must be observed under penalty of dismissal are, first, prohibition of spitting upon the floors. All persons in government employ are thus positively forbidden, but those who have tuberculosis have this penalty attached; second, the tuberculous employe is forbidden to spit in public spittoons and must provide himself with an individual sputum receiver; third, they must provide their own drinking glasses, soap and towels, and shall not use those provided for the general use.

Now, the question arises, how is it to become known who among the employes are consumptive? The method of ascertaining this information is left to each of the executive departments to work out. Generally speaking, cases of tuberculosis, if at all advanced, are already known, and it is believed that the chief clerk of each department will make reasonable inquiries for such cases, and when the plan is thoroughly understood among the employes themselves, and the order of the President of the United States is fully appreciated, the neighbors of anyone suspected of having tuberculosis will naturally, for their own protection, demand the enforcement of the rules, and with perfect propriety call the attention of the chief clerk to the individual.

The committee appointed by the President, transmitted under date of April 12, to the head of each of the executive departments in Washington a copy of its report to the president, including the printed forms 1, 2 and 3, with the information that such numbers of the printed forms as might be desired for distribution could be secured on requisition from the public printer, thus leaving it to each head of a department to transmit the information and the instructions contained in the executive order to the employes of his department, in such manner as he might deem proper.

In this manner it is expected that the rules with regard to employes

will become effective in a very short time throughout the United States.

2. *With Regard to Buildings.*—Regulations for the care of government buildings, offices, and workshops (form 2), to prevent the spread of tubecrulosis therein, have been printed on cardboard and are now being distributed by the departments to the different buildings throughout the country, and also separate cardboards containing the printed notice "Do not spit on the floor. To do so may spread disease."

All the foregoing measures, it is contemplated by the committee, are either now, or will shortly be, put into operation throughout all government buildings, offices, and workshops.

The sanitary inspection of buildings provided for in the executive order must of necessity require a greater length of time. A start has been made in the city of Washington, and with the experience gained here the inspections will be gradually extended throughout the United States.

Under the terms of the executive order, the public buildings under the war and navy departments will be inspected under boards of medical officers appointed by the respective surgeons-general of these two departments. All other public buildings will be inspected by boards appointed by the surgeon-general of the Public Health and Marine-Hospital Service. The reports of these boards will be made under two distinct heads: (1), insanitary conditions immediately remediable; and, (2), insanitary conditions requiring structural changes.

The reports of all the inspection boards will be received and considered by the committee composed of the three surgeons-general, who will transmit them, or a full report upon them, with recommendations, to the President. It is expected that the President will refer these reports to the heads of the Departments to which they relate for necessary action.

The organization of this great work as outlined above has been most carefully considered, and with the disposition which has already been shown on the part of the departments to carry out with energy the behests of the President in the matter, it is confidently expected that much good will result.

INSURANCE OF INDUSTRIAL WORKINGMEN AS AN INSTRUMENT OF TUBERCULOSIS PREVENTION

By Arnold C. Klebs, M.D.

Chicago

The moneys which set in motion and keep working the ever-growing machinery of tuberculosis prevention in this country, are with few exceptions supplied by voluntary contributions, given with charitable intent. Some institutional provision for consumptives has been made out of government funds; these of course are preventive measures also, but the tendency is to class them also as charitable institutions. This holds good for almost all our public hospital and relief service, and as Duclaux expressed it, "we have remained anchored to that idea of charity, a very noble, very beautiful idea, looked at from the view point of the one who follows it, but a false, almost absurd, idea, when one contemplates the benefits society can possibly derive from it."

That this is the case with us, renowned as we are for our practical sense, is particularly astonishing, because we have learned to recognize tuberculosis as a social and economic problem, probably the greatest of all problems, which by a systematic and sustained effort is eminently preventable. Such an effort must be planned, it must look forward, which charity never does; the latter cares and provides for the poor and the sick out of pure sympathy. It does signal service to suffering humanity, but here is where its legitimate field, its noble mission ought to stop, its services applied to fields of prevention or any problem needing a concentrated, sustained effort for the benefit of society are altogether misplaced. It is wrong, and it disturbs the directness and efficiency of our actions against infectious, communicable diseases to base them on the idea of charity. We must do away with it and put in its place the right of self-defense, which however we can and must exercise with the highest humanitarian spirit.

The problem of tuberculosis, however, cannot be attacked by the same comparatively simple measures which are successfully employed against the acute infectious diseases. Here antiseptic precautions and quarantine generally suffice. Tuberculosis also, for so long considered an incurable disease, has, up to very recent times, called forth antiseptic measures to the exclusion of any others. The destruction of infectious sputum and disinfection were the principal methods recommended and more or less enforced. Convincing evidence, however, has taught us that, although tuberculosis is undoubtedly caused by an infectious microbe, it is only conditionally communicable. The natural powers of resistance against its invasion are very great and the causes which lower this resisting power are well known to us. They are numerous and intimately related to our mode of life, our habits, our bringing up, our housing, our occupation; in one word, to the customs and exigencies of modern civilization.

Given the facts of its communicability and the opportunity for infection, together with the knowledge that the consumptive individual is the only source of the infectious material, the necessity and the direction of antiseptic measures is clearly indicated and we have only to determine which methods are the most efficient. But given also the facts that we are naturally very resistent to this infecting agent and that we can therefore regard it with a certain degree of complacency, we must, in view of the tremendous prevalence of the disease and its great economic importance, concentrate our principal efforts against the evil effects of certain conditions in our civilized life, which we know lower the naturally high resistance which our race possesses against the disease.

All this means therefore efforts against long established and deeply rooted prejudices, against unhealthy habits and practices, against pauperizing agencies; in short, against all those factors which undermine the health and strength of individuals and the nation. Education, specific, popular, well directed education is the watchword and the promising remedy for these evils in our times. In the matter of tuberculosis an educational campaign is well under way in this country, but it needs focusing, concentrating. The task is bewildering by its endless exigencies, but it can and will be fulfilled. If we place education, as we ought, in the front ranks of our campaign, we must have the proper instruments to apply it, we must have schools wherein to teach, we must have teachers who know their subject thoroughly and how to

teach it effectively, we must have the means for objective practical demonstration. But all this requires money, much money; we may have to call on the voluntary giver to help us in the building, but for the maintenance we need steady, reliable resources, resources which will naturally meet the exigencies and which need not be made available by spasmodic appeals. It might be said that such a plan is vague and fantastic, that it dreams of world reform and the eradication of all evils, and that because it attempts too much it will accomplish nothing. That this is not so can be proven by examples of successful, eminently successful efforts in the direction of such a plan. The fact that of necessity we must go step by step to come to perfection must not discourage, even if we may realize that the ideal can never be attained.

If the right and the duty of self-defence is to be the basis of our efforts, it is the one most attacked who ought to bear the largest share of the burden. To make him who is attacked, though he has not succumbed yet, an object of charity, is demoralizing, pauperizing practice. To show him how to help himself, to look forward for possible trouble on account of his exposed position, is the soundest and a perfectly practicable method. In the case of tuberculosis, who is the most attacked, most exposed one? There can be no doubt that it is the working man and especially the one employed *in certain industrial enterprises.* He is an asset, a very valuable asset, in society, and *society has a duty,* an interest to show him, if he does not see it himself, how he can preserve his economic integrity. His sole capital is his *sound body,* and if that becomes defective his income ceases.

Let a disease come to him, one which kills outright, as does pneumonia or a grave injury—the very suddenness of the catastrophe, after the shock has passed, carries in itself the stimulus for readjustment, the family will rise to it, they will adjust themselves, finding ready helpers, affected by the tragic and awful element in the calamity. But let a disease come to this same worker, one which will gradually but continuously sap his vitality, reducing his earnings, progressing all the time slowly, very slowly, but surely—he sees before him, not death, because next week he will be better, but hunger, distress, poverty, for himself, for his wife and the little ones. And so he borrows, hoping all along for the next week when he will be better, and this hope sees him soon in bed, from which he never will get up until he is carried out. And this has gone on through years, he has not paid his creditors, they

are his enemies, his old friends he has lost, they gave him up long ago when he began to earn less and less out of "pure laziness." Such is the story of the consumptive working man and when death has ended his misery, his family belong to the pauper class, robbed of all courage, diseased in body and mind, not able any more to readjust themselves—a tax on society. All this misery slowly creeping over a happy, self-supporting and self-respecting family, barred from all the tragic elements of the sudden catastrophe and the help it brings, all the possibilities of a spread of this awful disease which it fosters in the bosom of the family, all this stupendous though unappreciated tax on society, all this is preventable.

It is well that we bring before our eyes this sad picture, because we usually see only the end of a long sequence of events and accept it with fatalistic resignation as the inevitable. In trying to find out what tuberculosis means, we count up the fatalities and are astonished at the great numbers; we do not think of the casualties in this great battle, which make the disease the greatest of all problems. And what have we done so far to help the working man against this, his greatest foe? We give him nicely printed rules of how to lead a healthy life and so prevent consumption, we invite him to our expositions and show him that people can be cured of the disease by sleeping out of doors and by being treated in sanatoria, but before all we tell him he must not spit or he will infect everybody around him. Some professional philanthropists are very strong in this sort of education and expect wonders from it and forget entirely that in a problem of such stupendous dimensions these laudable efforts are but drops in an ocean. It is a slow and wholly inadequate method, but one not to be discouraged as long as we have nothing better.

How shall the workingman grapple with a problem of such stupenduous dimensions? We have an example of how he has done it with signal success and it is worth while to analyze it. I think of the system of obligatory insurance for workingmen in Germany. It has become *the most powerful factor in tuberculosis prevention in that country.* Every workingman *of a certain wage scale* is obliged by law to insure himself *and his family against sickness,* invalidity and old age. His employer deducts one-half of a certain proportion of the employee's wages and after adding the other half to it himself, remits the total to the insurance authorities who are in charge of the funds. The contributions to this fund are a very trifling tax on the working man, but

the benefits are very great. In case of disabling sickness the insured gets for twenty-six weeks a sick benefit, one-half of the customary or day wages, his relatives, if he is taken care of in a hospital, get a sum of at least one-half of the sick benefit. At death or during confinement premiums are also paid. The invalidity insurance provides for those whose disability exceeds twenty-six weeks, also assisting a family during the treatment of the patient. This latter, particularly, has been utilized to give the workingmen the benefit of a systematic and practical method of tuberculosis prevention.[1] This opportunity was given by paragraphs of the invalidity insurance law which make it a duty of the insurance office to provide at its expense proper treatment for the purpose of preventing disabling invalidity. This law thus provided the workingman out of funds which he himself supplied, with most excellently equipped and managed institutions, which were established by the insurance office. The tremendous expenditure necessary for this has been amply justified by the *results*. Since it was found that in certain industries 50 per cent. and more of the workingmen were suffering from tuberculosis and would sooner or later have their earning capacity reduced and finally become disabled, thus taxing

[1] The German sickness insurance and the invalidity and old age insurance must not be confounded. They are different though they supplement each other.

The insurance offices against sickness are regulated by the law of June 15, 1883, they are supported by weekly premiums, the total amount of which depends on the wages, the maximum being of 15½ cents, corresponding to daily wages of at least 82½ cents. In return the office has to provide the sick with medical care, medicines, sick-benefit and in case of death, a death-benefit dependent on the amount of the wages, is paid. The obligatory subscribers to the sickness insurance funds are the same whom the law of February 22, 1889 requires to insure against invalidity or old age.

The latter obligation is extended to every person, older than 16 years, ending wages or salary of less than $500 and which can be enumerated as follows: workingmen, laborers, apprentices, domestics, commercial and clerical employees, sailors on ships on sea or rivers. The premium, the amount of which is regulated by the wage scale, does not exceed 7½ cents per week and is paid in equal shares by the workingman and by the employer. Every insured who has paid his premiums regularly during a minimum time (about 200 weeks) has right to a pension if he has lost his working capacity (not through accident), or when he reaches the age of 70. This pension is composed of a fixed contribution, supplied by the state, of a fixed compensation furnished by the insurance office and by an extra payment, depending on the number and value of subscriptions made by the workingman, that is on the duration of affiliation with the office and his value as a wage earner. This pension however does under no circumstances exceed $47.80 per year. The average amount of the contributions by the insured of which the employer pays one half is about $5 per year. (Duclaux.)

very heavily the insurance funds, preventive measures had to be instituted as a matter of self-defense pure and simple.

The vastness of the undertaking may be gathered from a few figures. Under the law for sickness insurance there have been paid for the benefit of the insured from 1885 to 1903 nearly three hundred million dollars, and from the invalidity insurance funds from 1891 to 1903 two hundred million dollars; and during the last eight years the invalidity insurance offices took care (for an average of three months for each case) of 101,806 tuberculous patients, at a total expenditure of about nine million dollars; 90,000 of these patients were taken care of in sanatoria established by the insurance office.

The protective machinery was started with the establishment of sanatoria, there are now in the neighborhood of a hundred throughout the empire. This was done because the treatment of consumptives in properly equipped and managed sanatoria had given the best results in the hands of private individuals. To return the insured as soon as possible to earning capacity, to prevent invalidism, was the business proposition. This the sanatoria accomplished in from 70 to 80 per cent. of the patients treated and by the saving of dividends justified the initial expenditure for these costly institutions.

Needless to say with German thoroughness *exact data* were kept and statistics compiled. From these it soon became evident that better results were obtained, the earlier the patient's disease was recognized and sanatorium treatment instituted. The sanatorium had trained a great number of physicians to a thorough understanding of this fact and its fundamental importance and with their help the insurance office was put in a position where it could properly classify the patients whom it was obliged to take care of. It restricted the use of the sanatorium more and more to the earliest cases, thus improving the results achieved and insuring their permanency. This meant, however, provision for those patients who could not be considered appropriate subjects for sanatorium treatment and in the last years this fact has been the impetus for the creation of other institutional provisions, in a sense even more important for the prevention of tuberculosis, than the sanatorium.

Again this was dealt with on business principles with the underlying thought that prevention pays best and that therefore the maximum effort had to be given to the curable, preventable case, the minimum to the incurable one. By making contracts with hospitals and by also establishing such out of the funds, the incurable case was provided for

in a way much less expensive than in sanatoria. For those cases on the borderline of curability and incurability, *observation stations* were created, simple open-air day camps where the patient could spend his day in the open air, well fed and properly supervised. These camps, "*Genesungsheime*," convalescent stations, of late have been also utilized for patients dismissed from the sanatoria. In the sanatorium the patient had gone through a regime of rest in the open air, here he is held to occupation in order to fit him better and more permanently for work and if his former occupation was such as to expose him seriously to the probability of a relapse, a chance was given him to learn other pursuits, in which he could not only earn a living, but improve his bodily condition and make permanent the benefit derived from the sanatorium regime. Similar camps but with a somewhat different purpose have sprung up at the same time for those cases in which for some reason or other tuberculous trouble was anticipated, though no definite diagnosis could be made. I refer to the "*Erholungsstätten*," open-air rest camps, this term can be translated. Situated near cities or great industrial centres they offer to "run-down" workingmen a vacation, a rest in the open air with good food and no care, since his family is also provided for, a luxury which thus far only the man with capital could indulge in, but a very important factor in the prevention of a disease which is so insidious in its beginning that it will often be impossible to make a diagnosis until conditions are irremediable.

All this does not yet cover all the details of this admirable preventive machinery, the connecting link is provided for by the most important institution of the "*Fürsorgestelle*." Information and advice station it might be called, though this only describes one phase of its activity. They correspond in some ways to the French dispensaires, inaugurated by Calmette, but they are simpler, more compact and their effect more far-reaching because they work in intimate association with the factors above described. They primarily give information to patients, but they give no relief themselves, they direct and advise appropriate relief and treatment, as the exigencies of the given case may demand, the insurance agencies providing the same. But they do a great deal more, they exert a hygienic and sanitary supervision *over the patient's family and his home*. They employ for this splendidly trained and experienced nurses. The physical condition of each member of the family is determined and supervised. Children in defective health, so discovered, are taken out of city schools and sent to the country or sea-

shore or if that is not needed they continue their studies in the so-called "*Forest-Schools,*" where the classroom is a forest or a simple open shelter in it, where they are properly fed and their bodily and mental welfare looked after.

I have dwelt *at length* on the details of these provisions, because it seems to me necessary to emphasize that it is not the insurance principle as such alone, which is important as an instrument of tuberculosis prevention. The payment of sick benefits and premiums alone can never accomplish what properly conceived, planned and managed provisions, as described, can do. Through the latter is brought about the appropriate and effective juxtaposition of muscular power and brain power for the common good. There in Germany a *wise government* has conceived and initiated the plan, it has given to those whose health is their principal capital the opportunity to save a penny in the right time, to use it when it is sorely needed, it has made the employer contribute his share to it, for he also is interested in the good working condition of the one he employs. The employers have *gladly* responded to the call and in many instances they remit the whole amount instead of the obligatory one-half. The workingmen *at first resented the tax* and the order of the paternal government, but they soon found how much they were the gainers and now there is pretty general satisfaction with the plan and the utilization of its provisions has become a matter of course.

To us here, with our individualistic tendencies, with what we are *pleased to call personal liberty,* anything savouring of paternalism or governmental coercion is eminently distasteful. But as our institutions grow older and more complex, we become more conscious of the wastefulness and other shortcomings of an unrestricted application of the individualistic doctrine. The necessity of individual submission to social exigencies becomes more and more appreciated. *The wave of moral reform* which has struck this country is a manifestation of this tendency and is sure to be followed by one for physical betterment. In this tuberculosis must surely become the most prominent point of attack.

Mr. W. J. Bryan has recently said, very justly, "individualism and socialism define tendencies rather than concrete systems," so we need not become sectarians or pedants if we lean more towards one side than the other. In general all government is more or less socialistic and certainly the management of the German insurance plan deserves

this term, for it means collective ownership and operation of all its provisions and institutions through the State for the benefit of society. By distributing insurance offices throughout the empire, by respecting the personal liberty of the individual to the fullest extent as far as the interests of the common good will allow it, *by permitting a voice in the management of the plan* to those most interested, individual initiative is not suppressed but furthered. The workingman simply takes what he has paid for, *he owes nothing to charity* and when he goes to these institutions to regain his health he feels at home. The promotion of this state of mind is very important, the charity system brings demoralization, loss of self-respect, pauperization of a class whose principal defect in its social struggles is lack of acquaintance with fundamental principles. It can pay for the teaching but it needs the leaders, teachers and the schools.

The possibility of an obligatory insurance system for workingmen in this country is looked at with grave doubt. The reason for this is twofold, the one a general aversion to *coercion* already alluded to, the other an unfavorable comparison with existing insurance institutions. The latter shows insurance as an expensive machinery, too costly for the class under consideration for the benefits it can offer. Agencies and collections are chiefly responsible for this high cost. With a total expenditure of about 26 per cent. of the premiums, statistics show that the present-day agency system costs the policy holders of American companies over 16 per cent. of all premiums paid, *i. e.*, sixty millions out of 378 million dollars of premiums in 1904.

So-called industrial insurance, small policies with weekly payments, taken chiefly by wage-earners and their families, provides from 50 to 60 per cent. of its premiums for expenses, caused by the great cost of "writing" and collecting these small amounts one at a time (J. P. R. Jr.).

In the German obligatory system, where the moneys are simply deducted from the wages and forwarded by the employer, all this expenditure for agents and collections is saved. A private corporation also guards itself against bad risks by medical examination of applicants, thus excluding many in need of it. The obligatory system accepts everyone as long as he is capable of earning a certain sum, holding that those earning less or more can and must in the first case be taken care of by charity, in the second case take care of themselves.[1]

[1] Professor C. R. Henderson places the minimum of existence for American conditions at $600 in a family of five persons and considers as proper subjects

Insurance by private corporations, however, can be so managed that it will be made economical and accessible to the wage earner. There is a plan now being perfected for the formation of such an organization in Massachusetts, modeled after English companies who by doing away with the agency system, selling insurance over the counter, have brought the entire expense down to *4.6 to 9 per cent.* of the premiums. It is counted that such a system will bring about a reduction of 15 per cent. in premium rates and that industrial insurance can be furnished at a saving of from thirty to forty per cent. of the rates now charged by the present industrial companies. The latter saving to be accomplished *by abolishing the collecting system,* through cooperation of the employers, who are expected to attend to the solicitation and collection for the entire force of their employees.

Certain large corporations, employers of great numbers of working men, have for some time seen the necessity of protective insurance relief or benefit provision for their employees and have put such a system into working operation. In these relief departments the company usually provides the administrative expenses and guarantees the whole undertaking reserving to itself the right of representation on the managing board. Some of these departments, especially those of some railroad companies, are splendidly managed and have proved immensely useful to the workingmen. The subject of *prevention of disease,* however, has not been attacked by them, but there is no doubt that it is bound to come.

Fraternal associations, friendly and benefit societies, unions have all certain insurance features and some of them would seem to have sufficient means to grapple with the problem of tuberculosis prevention. Concrete plans in this direction have. as I understand, been submitted to the National Fraternal Congress, resolutions were passed and a committee appointed to investigate the matter. The beneficiary orders have a membership of 5,000,000, together with the purely fraternal orders 8,000,000. At a *penny per month* $600,000 to $960,000 could be collected, which, it is figured, will amply suffice to purchase the ground and erect a sanatorium and that *one cent per member twice a*

of obligatory insurance the large class of workingmen who earn between $600 and $900 per family (including earnings of wife and children). He thinks that this may be extended downward to $400 and upward to $1,000 in some localities, and that above $1,000 a special provision may be made for optional use of the insurance offices up to $1,300 or so. (The German law places the upper limit at $500.)

year thereafter would maintain the institution. The plan is proposed principally on financial grounds and on the estimate that $9,000,000 have to be paid yearly out of the treasuries in death benefits for those who have died from tuberculosis.

These plans have their duplicates in England. There a National Committee for the Establishment of Sanatoria for workers has been formed at the initiative of the Hospital Saturday Fund. In this committee are represented various benefit societies. A sanatorium for 200 patients, to cost not more than $250,000 ($1000 to $1250 per bed), is to be established and to be made self-supporting by endowments of beds by friendly societies for use of their members (at the rate of about $6 weekly per bed). A site of 250 acres is selected and the plan provides for the establishment of a farm colony, where those patients whose condition allows it can learn horticulture, fruit growing and other desirable out-door pursuits. The capital sum necessary for the erection of buildings is estimated at about $250,000, which is to be raised by public subscription and with the assistance of the friendly societies.

This combination of benefit associations is certainly worthy of interest and should induce imitation. It may perhaps be well to outline the scheme proposed by the post-office employees, by which they intend to cover the expenses for treatment of their fellow-workers in the above sanatorium. It has been figured out that a deduction of half-penny a week from the wages will supply ample funds to endow fifty beds and the postmaster-general has consented to such a deduction being made by the proper officers from the wages of post-office employees who give their consent. Any employee contracting tuberculosis and found suitable by the physician for sanatorium treatment, can be admitted free of charge to the sanatorium with six months leave on full pay to enable him to provide for his family (Latham).

We have certainly plenty of strong associations of workingmen in this country, heavily taxed by tuberculosis, who could take similar action. The cigarmakers' union, for instance, as it was recently shown in an admirable address made by its president, Mr. G. W. Perkins, at a conference of the Chicago Tuberculosis Institute, expended in 1905 20 per cent. of its death benefits on account of those who died from tuberculosis and 24 per cent. of its sick benefits for those suffering from the disease; that is a total of about $73,300.

All these examples show efforts in the right direction and a realiza-

tion that the problem of tuberculosis must be met by methods and measures supported primarily by those most interested. But the question of tuberculosis prevention, it must be remembered, cannot be solved only by introducing inexpensive insurance and by building sanatoria. The insurance must be guided and utilized for appropriate provisions, and of this the sanatorium is only one, as is well exemplified by the experience in Germany. A sanatorium which is only instituted for the purpose of curing and restoring the workingmen to earning capacity does not fulfill its mission. If it is not primarily used as a school for practical demonstration and teaching of principles and methods of hygiene and prevention, I for my part would rather do without it. The expensiveness of its construction in Germany, England, France and to some extent also in this country, prevents its needed multiplication and also defeats its purpose as a school. *Don't let us imitate Germany* in this respect by building palaces for the consumptive workingman, who cannot help but feel discontented when returning to his unpretentious home. The desired end can be accomplished by very simple, inexpensive and equally if not more efficient buildings. In this direction our country is probably leading the way.

The sanatorium, however, even if built according to these principles, must be regarded only as one factor in tuberculosis prevention, to become really effective it must be supplemented by institutions and provisions similar to those which long experience has evolved in Germany. It may stand in the center of our efforts, but we must not put all our faith in it.

In reviewing the whole subject we cannot fail to realize the tremendous interest which the industrial workers have in this struggle. We must show them how to help themselves, how to save in time a penny to be ready to meet this greatest foe of theirs. We must do away with the false idea of charity in assisting in those features of the problem which particularly touches them. If we do it on the lines shown, either by obligatory government insurance against invalidity or by organized interest and voluntary insurance, we put the whole struggle on the basis where it belongs, that of the right to self-defense of the attacked. Then the tuberculosis crusade will become what it ought to be, not only an effort against a disease, of which we have just become conscious, though it has long been with us, but a fight for better conditions generally and particularly among the great mass of honest, self-respecting workmen. Let us hope that the efforts made

towards giving them the means through insurance, as this is now under consideration in some states, may prove successful.

DISCUSSION ON DR. KLEBS'S PAPER

Mr. Frederick L. Hoffman, Newark, N. J.: Regarding the system of compulsory insurance for workmen in Germany, it is unfortunate that certain important facts are generally overlooked or ignored. Germany is par excellence a paternal state, in which individual freedom and responsibility is subordinate to an efficient method of government control and restraint, elaborated into minute rules and regulations which citizens of a republic would not tolerate for a moment. A social policy such as underlies the German State could never be carried through in the American republic and in my opinion it is a mere waste of time and effort to discuss the subject of compulsory insurance for American workmen, either for the diminution of accidents or disease in general or tuberculosis in particular. The subject is much more complex than generally assumed, for the facts are extremely involved and the issue is beclouded by sentimental considerations on the one hand and an enormous controversial literature on the other. The German system of workmen's insurance, so-called, is in fact not insurance at all, but more accurately a state provision for the majority of wage-earners against the financial consequences of industrial accidents, sickness, and incapacity in old age. As I understand it, neither the really poor nor the pauper element are within the sphere of this system of so-called insurance, which is in part provided for by deductions from wages, and for this reason inapplicable to the casual laborer, hand trades, domestic industry, etc. A considerable proportion of the contribution is paid by the government, or, more accurately, derived from taxation, so that in truth and in fact this system of so-called insurance is really a modified poor law, on the whole intelligently adopted to existing needs and co-ordinated with characteristic German thoroughness to the whole social policy of the imperial government. It would carry me too far to discuss in detail even the more important facts of this experiment in extreme state socialism. Naturally, much good has resulted therefrom, but it an open question whether certain benefits have not been purchased at the cost of the higher ethical and economic qualities of the German population. There has neither been the expected reduction in the frequency and mortality of industrial accidents, nor has there been the

anticipated reduction in the frequency of sickness generally, or tuberculosis particularly. For reasons which I cannot discuss at this time, the mortality from tuberculosis has always been relatively higher in German than in American cities and the reduction which has taken place during the last twenty years has, therefore, naturally been somewhat greater relatively in proportion to the earlier prevailing rate than the corresponding reduction in American cities. During 1882–1886 the rate for German cities was 3.46 per 1,000, which during the intervening period of years has been reduced to 1.99 in 1902. In American cities, without either the system of compulsory insurance on the one hand or of the supplementary institutions for the cure of workmen suffering from incipient phthisis on the other, the reduction has been from 2.98 per 1,000 in 1882–1886 to 1.84 in 1902. That is to say, the actual reduction in the case of German cities during the period of years since government insurance has been in full operation, was 1.47 per 1,000, against 1.14 for American cities, but taking the rate during 1882–1886 as 100, the rates during 1902 were 57.5 for German cities and 61.7 for American cities. So that there has been in both countries, and I may say, practically in all other civilized countries, a very considerable reduction in the mortality from tuberculosis, which can neither be credited to government insurance of workmen nor to the specific treatment of workmen in special institutions for their care. This does not at all argue against the value of these institutions in individual cases, but I merely point out that the facts do not warrant as far-reaching conclusions as are generally adopted.

The chief problem which underlies the entire tuberculosis question is the vastly greater importance of the prevention of the disease than its cure. Society in this respect has a most important duty to perform, by ascertaining with scientific accuracy the causes responsible for the prevalence of tuberculosis on the one hand and the methods and means by which the disease may largely be prevented on the other. A great responsibility also rests with the workmen themselves who do not clearly realize that they have much, if not most, of the solution of the problem in their own hands. What is imperatively needed is the intelligent education of wage-earners in the facts of industrial hygiene and factory inspection and its relation to the more or less effective prevention of industrial accidents and industrial diseases. The official German literature on the subject of workmen's insurance is in many respects misleading and of small value to Americans interested in the

tuberculosis problem, for the conditions both social and political are so radically different as to be inapplicable to American life.

As a financial proposition, I am confident that the German system of sanatoria for consumptive workmen can never be made to rest upon sound actuarial principles and be made a paying proposition. From the standpoint of benevolence the idea has a great deal to commend it and excellent results in individual cases are a matter of trustworthy record. I, personally, am not at all opposed to the idea of sanatoria, but the proposition that insurance companies, for the benefit of their policy holders, should maintain such hospitals for special treatment, is contrary to the most elementary principles which underlie these institutions. Even if it were possible to make it a matter of financial consideration and affect cures in the majority of instances and of lasting benefit, the principles of equity would oppose discrimination in favor of policy holders suffering from tuberculosis, while not granting corresponding medical or surgical treatment to those afflicted with other diseases or the results of accidents and injuries. I, however, am fully convinced, after a very careful investigation, that as a financial proposition the treatment of tubercular policy holders by American life insurance companies in special institutions for their cure, is absolutely impossible. This applies also to the organization of special societies or companies for the exclusive insurance of tubercular policy holders.

German government insurance has been a subject of considerable public interest during recent years, but I am confident that there is no hope whatever, without a radical change in our fundamental institutions of government, for the organization and development of a corresponding system of voluntary or compulsory government insurance in this country, and the time wasted on the subject could, in my opinion, be used to better purpose in efforts to extend by public discussions the knowledge of simple and practicable methods and means by which tuberculosis among men engaged in occupations or trades most subject thereto can be materially reduced. I repeat that, in my opinion, the true problem is one of prevention and not of cure, and one of the most useful additions to our knowledge would be a comprehensive and strictly scientific investigation into the diseases of occupation with special reference to consumption and the pathology of dust inhalation in its relation thereto.

Dr. John H. Lowman, Cleveland: Some relief should be given to the workman during sickness, even though it may not be possible in

this country to carry out the German plan of insuring against accident, sickness and old age. At present we have nothing but the mutual benefit societies. It is impossible to estimate the amount of relief given by these societies for tuberculosis because their statistics are so imperfect. Many of the unions merely indicate that the member is sick and do not specify the form of the sickness. The simple request for information has, however, awakened in many of them a determination for greater accuracy.

These societies, although supplying a costly insurance as compared with government insurance, should nevertheless be encouraged and extended. They will become indirectly a valuable means of reaching the people themselves.

The question cannot, as Mr. Hoffman says, be left to the workman himself. He must be guided and directed along the best road and not left to work out his own destiny on a question so important as this. The employment of safety devices against accident must in some shops often be enforced against the wishes even of the workmen—strange as it may seem. Sometimes these devices interfere with the work, make the distance from one machine to another more circuitous or entail the use of clumsy apparatus, all of which precautions the workman as he grows more confident and reliant wishes to dispense with. He is not provident of the future, and as he will often discard devices provided for his safety, so will he let his insurance lapse. No amount of academic discussion will influence him and since we cannot force him to be insured we must work with him in his unions and societies and keep constantly before him his risks and dangers.

This is a valuable part of the work of a local tuberculosis society.

PATHOLOGICAL AND BACTERIOLOGICAL SECTION

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LOCALIZED TUBERCULOUS LEPTOMENINGITIS

By D. J. McCarthy, M.D.

Philadelphia

(From the Laboratory of the Henry Phipps Institute.)

In an examination of one hundred and seventy-eight brains from patients dying of pulmonary tuberculosis, four cases of tuberculous meningitis restricted to one area of the brain were found. In two of the four cases the meningitis was restricted to the posterior fossa, affecting the cerebellum, the pons and the medulla. One case was the usual type of extensive tuberculous meningitis affecting the base and the convexity. One case presented a proliferative type affecting the meninges of the brain and the spinal cord.

The occurrence of localized forms of meningitis in advanced cases of tuberculosis is of considerable interest. One of the cases of tuberculous meningitis restricted to the posterior fossa of the brain has already been reported in volume one of the Henry Phipps report. The other case follows the same type. A thick plastic exudate was present over the superior surface of the cerebellum, with an inflammation of a minor degree over the inferior surface, the pons and the medulla. The symptoms produced in both cases were not so distinct as would naturally be expected from the extent of the lesion. It should be remembered, however, that both cases were bed cases, in a very advanced stage of tuberculosis, and that disturbance of gait, position, etc., would not be so manifest under such circumstances as they would have been had the cerebral lesions been uncomplicated by the intense weakness and toxemia of the pulmonary condition. Persistent occipital headaches, rigidity of the muscles of the neck, increased reflexes, marked fatigue, and terminal delirium were present in both cases. Neither of the two cases were diagnosed ante-mortem.

The fourth case was one of acute leptomeningitis restricted to one

cerebral hemisphere. This case presented the lesions of a typical tuberculous meningitis confined to one cerebral hemisphere and more particularly to the distribution of the Sylvian artery. The case is of considerable interest both from a clinical and pathological standpoint. It represents, from a pathological standpoint, a method of infection of the cerebral meninges from a pulmonary lesion. The localization of the inflammation in this case to the distribution of one cerebral artery is evidence of the transmission of the infection through the arterial circulation. The case is as follows:

Case No. 3440. Age, twenty-six. Admitted 6–14–'05. Died 8–11–'05. Two sisters had died of pulmonary tuberculosis. The patient had had the usual diseases of childhood; pleurisy sixteen months ago, and gonorrhea five years ago. He had had pulmonary tuberculosis for the last sixteen months, and presented miliary involvement of the entire right lung and of the upper lobe of the left lung. The pulmonary condition advanced during the two months at the institute, with, however, gradual reduction in temperature, which varied between 101° and 102° F. The examination of the urine showed acidity, specific gravity 1022, a slight trace of albumin, no sugar, diazo reaction positive and a few granular and wax-like casts. The patient had two slight hemorrhages, one on July 12 and one on July 24. Dover's powder had been administered on August 1. On August 2 he had convulsions, Jacksonian in type, beginning in the left arm. He did not complain of headaches, and rested in a fairly good condition until August 3, when he had another convulsion. On August 4 there was a record of four convulsions; on August, 5, seven; August 6, nine; August 7, thirty-seven; August 8, fifty; August 9, fifteen; August 10, twenty-five, and August 11, thirty. On August 7, complete paralysis of the right arm and leg developed, with complete loss of power of the right face. The notes of the examination are as follows:

The patient is conscious, understands what is said to him, and obeys simple commands, such as protruding the tongue, closing the eyes, lifting the arm, etc. He is able to repeat simple words such as "yes" and "no," but is unable to hold articulate conversation. The right arm and leg are completely paralyzed and flaccid. The left arm and leg have apparently normal power. The knee jerk on the paralyzed side is present and quick and weak. There is no ankle clonus on either side. The Babinski reflex is present on the right side. There is some hyperesthesia of the right side. Flexing the arm or leg produces pain. The pupils are unequal, both more than middle wide, and the left larger than the right. There is no rigidity of the muscles of the neck to-day (slight rigidity was noted on examination on August 8, 1905). Immediately after the examination the patient had a convulsion which began with slight moaning and clonic jerkings beginning in the right hand and extending rapidly to the face and leg of the right side. The head was turned to the right and the right eye was closed by a clonic spasm of the orbicularis. Both eyes were rotated to the right. During the convulsions he placed his left hand on the twitching mouth. There is some question as to whether consciousness was entirely lost, on account of this movement. There were slight twitchings of the muscles of the face. He responded to simple command immediately after the convulsive movements ceased. If consciousness was lost it was only momentary. In an attempt to close the

eyes in response to a command immediately after a convulsion, the right eye did not close entirely, showing some weakness.

"The diagnosis rests between a localized infiltrating tuberculous lesion confined to the left hemisphere, cerebral hemorrhage and uremia. The history of the onset points to uremia. The examination of the urine at this time showed only a slight trace of albumen, specific gravity 1026. The mental condition, pulse, and general examination are also against the diagnosis of uremia. The onset, the mental condition and the localized convulsions are against the diagnosis of cerebral hemorrhage, and therefore in favor of a diagnosis of a localized inflammatory infiltrating tuberculous process of the left cerebral hemisphere.

Autopsy Report.—Examination of the Brain and Spinal Cord.—"On gross examination of the spinal cord there is a localized fibrinous exudate over the entire cervical part of the cord. Examination of the brain shows an acute tuberculous meningitis extending over the upper portion of the temperosphenoidal lobe and over the entire motor area of the left side. The frontal area is edematous; the occipital lobe is not at all involved. The base of the brain is practically normal. There is considerable edema of the left hemisphere. The right hemisphere is normal.

Microscopic examination shows inflammatory infiltration of the meninges, with tubercle bacilli in large numbers in the tissues. A careful study of the clinical picture in this case will show the difficulty of making a positive diagnosis. The case, as stated in the clinical notes reported at the time, was at first thought to be one of uremia, on account of the onset of the symptoms after an administration of opium to a patient who had previously shown evidence of kidney disease. The further study of the case led to the rejection of this diagnosis and the consideration of the possibilities of cerebral hemorrhage, cerebral thrombosis, brain tumor and meningitis.

While hemiplegia with complication is of frequent occurrence in uremia, and especially where the uremia occurs in individuals with arteriosclerosis, it is always associated with other evidence of deficiency of kidney function. A careful quantitative and qualitative analysis of the urine reveals evidence of deficiency of elimination. The total quantity of the urine or of its solid constituents (urea, etc.) is diminished. Albumin may or may not be present. Its presence is frequently in small quantities, and often only periodical. This is especially true in contracted states of the kidney. There is also evidence of uremic intoxication in the circulatory system, in the action of the heart and the high tension of the pulse. The examination of the eyegrounds will sometimes show an albuminuric retinitis. The mental condition of the patient is always an important factor in the diagnosis of uremia. Consciousness is practically never retained when the convulsions are so frequent as they were in the case under discussion. The hemiplegia of uremia, if carefully studied and kept under close and continuous observation, will often be found to be intermittent. There will be a diminution or complete disappearance of paralytic

symptoms from time to time. In the absence of practically all these symptoms with the exception of the convulsions, the diagnosis of uremia was excluded.

The gradual onset of the symptoms, the increasing frequency of the convulsions of a Jacksonian type, the retention of consciousness and the condition of the heart and pulse excluded cerebral hemorrhage.

The frequency and the character of the convulsions excluded the diagnosis of cerebral thrombosis.

The symptoms of brain tumor develop much more slowly and are much more frequently associated with change in the eye-grounds than in this case. The retention of consciousness is of much interest in view of the pathological findings. Consciousness is lost in tuberculous meningitis relatively early in the course of the disease. It is also lost, as a rule, in uremia. It is invariably lost in extensive cerebral hemorrhage. The retention of consciousness in this case, therefore, becomes of considerable diagnostic value. It indicates that we are not dealing with the usual type of tuberculous meningitis. The convulsions, the hemiplegia, the aphasia, localize the lesions to the left cerebral hemisphere, and especially to the motor area. The rapid development of the symptoms complicating the advances of pulmonary tuberculosis led to a final diagnosis of localized inflammatory condition of the meninges of the left cerebral hemisphere.

The transmission of the infecting agent from localized tuberculous foci to the meninges has been a matter of discussion for a long time. Where a tuberculous focus is in the immediate neighborhood of the meninges, the transmission may be by direct extension of the inflammatory process or by lymphatic transmission. Such foci are found in the bones of the skull—the mastoid, middle ear, ethmoid, nasal and frontal sinuses. Lymphatic transmission in this class of cases is much more frequent than infection by direct extension. When tuberculous meningitis immediately follows operation upon a tuberculous joint, it is difficult to understand how the infection could be otherwise than by direct blood transmission. Infection of the meninges complicating slight tuberculous lesions of the chest, such as tuberculosis of the peribronchial glands, etc., might be the result of either blood or lymphatic transmission. In very advanced cases of pulmonary tuberculosis with extensive cavity formation various types of tuberculous meningitis may occur. The presence of tubercles from the size of a millet seed to that of a split pea, in many tissues of the body, in a large number of

cases (see pathological report), points to a tuberculous bacteremia. It is surprising that tuberculosis of the meninges is not found with more frequency in such cases. The subacute leptomeningitis described later on cannot be considered as a tuberculous process, but rather as a result of continuous toxic irritation.

In miliary tuberculosis of the meninges the tubercles are found in the greatest numbers along the course of the blood-vessels. Hektoen has described them within the blood vessels.

Localization of the tuberculous lesions in this particular case to an area corresponding to the blood supply of one particular cerebral artery could not be otherwise explained than by a local infection in the distribution of this blood supply. There is, however, a possibility of lowered resistance due to interference in circulation leading to a localized infection. The type of inflammation and study of the rest of the brain does not give any support to this theory.

The study of a large number of cases of acute tuberculous meningitis will show two distinct types of tuberculous meningitis entirely different in their gross and microscopic pathology.

In one group of cases, the meninges are in a state of congestion, and large numbers of small pin-point miliary tubercles are found scattered along the course of the blood-vessels. In the other there is a thick plastic semi-purulent exudate mainly confined to the base of the brain and most extensive in the intercrural space. The first group of cases corresponds to the type usually found in children, and where the primary source of infection is a non-suppurating tuberculous focus. This type is also found in advanced cases of pulmonary tuberculosis. In the advanced cases with cavity formation and mixed infection the second group is more common. The second type is with the semi-purulent exudate over the base. It is rare to find in these cases any exudate over the convexity, although there often is extreme congestion and acute inflammation of the meninges. This condition represents a marked accentuation of the pathological condition described under the case heading "subacute leptomeningitis." The difference in the pathological manifestations of these two groups is in all probability determined by mixed infections.

Another form of localized meningitis is a chronic tuberculous meningo-encephalitis, secondary to tuberculous lesions of the meninges. Of the one hundred and ten brains examined at the Henry Phipps Institute and the Philadelphia Hospital, areas of cortical softening have

been observed in four. The gross appearance of this condition was so different from that seen in obliteration of the terminal vessels of the circle of Willis, that a careful microscopic investigation of all four cases was made. The anatomical distribution of the terminal vessels of the circle of Willis is such that when softening occurs from obstruction, there is either collapse or complete disappearance of the gyri affected. In none of these cases was there evidence of advanced or even moderate arteriosclerosis of the vessels elsewhere in the brain. In none of the cases was a unilateral hydrocephalus observed. In none of the cases was there any deformity of the gyri other than that of a superficial erosion. Sections of the pia-arachnoid establish the presence of small caseating tubercles containing tubercle bacilli over one of these areas, and leads me to conclude that the primary lesion of the pia-arachnoid, with secondary involvement of the cortex, either by direct extension, or, more properly, a local interference with the local cortical circulation by obliteration of the capillaries extending into the cortex from the meninges. Another possibility is a lowered resistance of the meninges over areas of primary softening of the cortex and a deposit of tubercles in this area. In one of the cases the presence of fibrinous nodules in the pia-arachnoid and in other areas of the brain was evidence of a previous local inflammatory disease of the meninges. This supports the former theory. The case is as follows:

Case No. 2676. Age, forty. Weaver. Admitted to the Henry Phipps Institute 8–11–'04, from White Haven. Died 2–1–'05.

One sister had died from consumption. He had influenza in 1893; pleurisy in September, 1893; and had used alcohol to excess. He had been ill with his present trouble for over a year. There was an involvement of both lungs, affecting the entire upper lobe of both sides. While at White Haven he had decided mental disturbance. He had hallucinations of hearing, systematized delusions of persecution, deficient memory and poor judgment.

The nervous examination made 1–14–'04 gave no evidence of organic disease in the central nervous system. "The reflexes are quick and the muscular power good; there is a fine tremor in both hands. The patient still has systematized delusions of persecution. The memory is poorer than it was, and is very deficient to both recent and past events."

Autopsy Record. Pathological Diagnosis.—Infiltrating tuberculosis with cavity formation of the entire right lung and the upper lobe of the left lung. Tuberculous ulcerated appendicitis. Amyloid disease of the liver, spleen and kidney.

Nervous System.—Gross examination: There is no atrophy of the cortical convolutions. There is no edema. There is moderate passive congestion, more marked on the right side. There is a slight grade of internal hydrocephalus. There is no arteriosclerosis apparent in the circle of Willis. The vessels appear to be soft, normal and collapsed. There is a slight roughening over the base of

the frontal lobes. There are a number of whitish areas in the pia along the course of the blood-vessels of the anterior portion of the base of both tempero-sphenoidal lobes. These are fibrous in nature. The pacchionian granulations along the anterior edge of the cerebellum are more numerous than elsewhere.

In the right hemisphere there are two extensive areas of superficial softening involving only the gray matter of the cortex, not associated with other deformity of the gyri. There is one area 4 by 3 cm. in the extreme anterior portion of the first and second frontal convolutions. The other area 3 by 2 cm. is in the posterior portion of the second frontal convolution with its posterior margin just anterior to the ascending frontal convolution.

In the posterior area the pia remains intact. This area is slightly depressed below the surface, and is yellowish brown in color. Along the entire posterior edge of this area there is a large number of small white fibrous nodules at its periphery, but they are not so numerous as in the posterior area. The same yellowish-white granules are seen here and there on the surface. There is evidence of calcification in some of the yellowish-white area. The veins and a larger branch of the anterior cerebral artery cross this area intact.

Microscopic examination: Sections were taken from the large areas of softening in the præfrontal lobe of the right side, and were stained by the Nissl, hæmatoxylin-eosin, elastic, iron hæmatoxylin, Van Giesen and Marchi methods.

Hæmatoxylin-eosin method: The area of softening is seen to involve the cortex and a very slight portion of the subcortex. The pia-arachnoid is intact, and both arteries and veins can be seen permeating the pia of this area. The meshwork of the pia-arachnoid is thickened and contains large quantities of dark pigment of degenerated blood, free and within larger cells. Immediately beneath the pia-arachnoid the brain substance has a reticular appearance, and in the immediate neighborhood along the free surface of the brain, just beyond the area of softening, there is a proliferation of the neuroglia. The blood-vessels appear to be normal. There is no evidence of distinct arterio-sclerosis. The ganglion cells in the immediate neighborhood of softening stain more deeply than those at some distance. There is some displacement of the nuclei in the cells in the area of softening. The remainder of the cortex, by this method, does not show any pathological change. The nuclei in the cells of the nucleus of the tenth nerve are displaced toward the periphery, and the cells stain deeper than normal. Within one of the venous channels of one of the pacchionian granulations numerous circular hyaline bodies staining a purple color with the hæmatoxylin are seen, attached to the wall of the venous channel.

Iron hæmatoxylin stain: This stain gives the same changes as have been described in the preceding method. Small capillary hemorrhages stained a deep jet black are present beneath the floor of the fourth ventricle. The pigment in the areas of softening stain a jet black by this method.

The Van Giesen method gives practically the same changes as those seen by the hæmatoxylin-eosin method. The blood-vessels stain much more distinctly. There is no evidence of obstruction. There are immediately beneath the area of softening a few capillaries, about which is a mass of delicate fibrils which stain red by this method. There are small capillaries extending into the cortex from the pia-arachnoid, and the red-staining fibrils are in all probability extensions from the pia-arachnoid.

Nissl method: The area of softening in this case extends through the cortex and involves only very slightly the subcortex. In the immediate neighborhood, that is, at the edge of the area of softening, the ganglion cells take a

very deep blue stain. There are ganglion cells in a condition of advanced degeneration, with complete disappearance of the chromophilic elements, and still others in an intermediate stage with displacement of the nucleus and diffuse chromaolysis. Through the area of softening in the rarefied cortex and in the pia-arachnoid, there are quantities of a golden and of a dark brown pigment. A few of the cells scattered here and there throughout the cortex are in a condition of pyknosis. The cortex is otherwise normal.

Elastic stain: All the sections were stained by Weigert's elastic stain in order to determine the extent of change in the blood-vessels. The elastic coat is intact and does not appear to be abnormal in the larger vessels within the area of softening. Apart from the slight thickening in the media in the vessels at the base of the brain, there is no evidence of pathological change.

Case No. 2347. Age, thirty-nine. Color, white. Occupation, steam-engineer. Admitted 5–3–'04. Died 6–10–'04.

Family history negative. The patient had been ill for three years with typical pulmonary tuberculosis. There was a wide-spread involvement of both lungs with cavity formation, including the whole upper left lung. There was no nervous examination. The gross pathological diagnosis in the autopsy is: Tuberculosis in both lungs, bronchiectasis in the left lung, thickened pleura, pericarditis, fatty kidneys, fibroid adrenal of the left side, calcification of splenic artery, fatty infiltration of the liver, and ulcers in the cecum.

Gross examination of the brain: There is no external or internal hydrocephalus. There is no arteriosclerosis of the circle of Willis. The meninges over the convexity appear to be normal. On the left side of the brain there are four spots of hemorrhagic softening, superficial in type, which are not connected in their anatomical arrangement with the distribution of the cortical blood-supply. In all areas of softening the pia-arachnoid remains intact, and the softening does not extend to a greater depth than 2 mm. The most extensive area in this case occupies the anterior distribution of the third cerebral convolution of the left side, and measures 4 by 2.5 cm. There is a smaller area measuring 1 by 2 cm., in the middle portion of the first temperosphenoidal gyrus. There is a small area 1 by 3 mm. in the posterior portion of the second temperosphenoidal gyrus. There is still another area 6 by 3 mm. in the posterior portion of the third temperosphenoidal gyrus. There are no areas of softening in the right hemisphere. All the areas have a yellowish-red appearance and are slightly depressed below the surface. They are covered by a thickened pia-arachnoid, through which the venous capillaries can be seen. Sections from the hemispheres reveal no pathological change in the centrum semiovale.

Microscopic examination: Sections were taken from the areas of softening, from the motor area, pons, and medulla, and stained by the Nissl, hæmatoxylin-eosin, elastic, iron-hæmatoxylin, van Giesen and Marchi methods.

By the hæmatoxylin-eosin method the vessels in the immediate neighborhood of the areas of softening are patulous. Arterial and venous capillaries are present in the softened areas and appear to be normal. The same is true of the intergyral vessels. Over the area of softening, the pia-arachnoid is distinctly thickened and contains large numbers of cells carrying hæmosiderin. Immediately beneath this and continuous with it, the cerebral tissues, both cortical and subcortical, are reticular in character, through the blood-vessels run intact, and in which only a few degenerated ganglion-cells can be seen. This reticulated tissue is composed mainly of neuroglia fibers, with here and there a swollen axis-cylinder; these latter are especially numerous at the junction of

the reticular tissue with the surrounding area. At the edge of the area of softening there is a marked proliferation of the neuroglia tissue, with the formation of large spider cells, and here and there a fan-like arrangement of hypertrophied neuroglia fibers. The neuroglia cells, even at some distance from the area of softening, immediately beneath the pia, are hypertrophied. The few ganglion-cells that remain in the area of softening and those in the immediate neighborhood, stain a purple black, with hæmatoxylin. The nuclear area alone remains clear and unstained. The entire cell body has a black granular appearance. The dendrites are swollen and fragmented. The ganglion-cells in the rest of the section take a light blue stain. In the neighborhood of one of the areas of softening a small area of calcification was present in the pia-arachnoid. There was considerable thickening in the immediate neighborhood of the area of calcification, without, however, any pathological change in the cortex immediately beneath it.

Iron hæmatoxylin method: All the changes above described are apparent and much more distinct in the microscopic picture by this method. This is especially true of the ganglion-cells, the neuroglia-cells and the fibers in the immediate neighborhood of the area of softening, all of which take a deep black stain by this method. A number of cells having the appearance of compound granule-cells and taking a light blue stain and at times a yellowish stain, were present in the areas of softening. The myelin in the subcortex takes a normal blue stain.

Van Giesen method: This method presents no evidence other than that of the other methods. The blood-vessels appear normal, and there is no evidence of obstruction of the subcortical vessels.

Nissl method: Ganglion cells in all stages of degeneration from simple pyknosis to complete chromatolysis can be seen in the immediate neighborhood of the softening areas. In some of the cells, evidence of proliferation is shown by a double nucleus in a single ganglion-cell. Care was taken in this observation to exclude a superimposition of cells, a leucocyte within a cell, or vacuolization of the cell. The cells above described as taking a purplish black stain with the hæmatoxylin-eosin method, and a deep black stain with the iron hæmatoxylin, take a blue granular stain, by this method. A type of cell degeneration is seen here, and resembles that occasionally met in toxic degeneration; one of the several fine filaments of chromatin extend from one pole of the cell to the other, the rest of the cell body remaining in a condition of diffuse chromatolysis and taking the blue stain very slightly.

Sections taken from the motor area present nothing pathological. The pons, cerebellum, and medulla show nothing abnormal with the exception of a perinuclear chromatolysis of the cells of the tenth nerve. Two small tubercles are present on the choroid plexus.

Elastic stain: A study of the sections stained by the elastic method does not show any marked pathological change in the walls of the vessels.

Case No. 3142. Age, twenty-six. Occupation, bookkeeper. Admitted 3-1-'05, in an advanced stage of pulmonary tuberculosis with cavities in both lungs. He had been ill for three years.

The nervous examination showed an accentuated condition of all the reflexes. There was no loss of musclar power or sensation. Objective examination was normal. The patient complained of marked hyperesthesia of both feet, with tenderness of all the toes except the big toe. There was marked curving of all the nails of the toes. There was no evidence of an active neuritis. The mental condition had changed distinctly since the lung condition had become advanced.

He was very suspicious of the intentions of all about him—a mental attitude which almost amounted to delusions of persecution. His memory was poor and he was of a markedly irritable, complaining disposition.

Microscopic examination: Hæmatoxylin-eosin method: In this area the pia is retained and thickened. The cortex has disappeared; the subcortex shows a reticular appearance, and at the edge of this there is a thin layer of marked gliosis. The subcortical vessels are normal. In the area of gliosis, beneath the reticular area, the glia-cells are markedly hypertrophied and present the form of spider-cells. Some capillaries in one portion of the reticular area are patent, but do not contain red blood corpuscles. In the smaller areas, evidently the beginning of the process, the outer cortical area is reduced to a delicate reticulum of neuroglia fibers. In this reticulum at one point there is an obliterated capillary vessel. The ganglion-cells immediately underlying the reticular area of the cortex are in different stages of degeneration, and at one point show some calcification. In the neighborhood of both these areas the ganglion-cells, by the Nissl method, show all stages of degeneration.

Nissl method: The ganglion-cells within the neighborhood of the area of softening are mainly in a condition of advanced pyknosis. Some of them are in a condition of more advanced degeneration than advanced pyknosis, with complete chromatolysis.

Case No. 3388. Age, thirty-six. Occupation, carpenter. Admitted to the Institute, 5–29–'05.

One brother has tuberculosis. The patient had denied syphilis or other venereal infection and did not use alcohol. He had tuberculosis for six months and pneumothorax for several weeks previous to death. There was no mental or nervous phenomena out of the ordinary. The autopsy showed a left-sided pyopneumothorax with cavity formation and infiltration of the upper and middle lobes of the right lung.

Microscopic examination: Hæmatoxylin eosin method: The areas of softening in this case differ from those in the preceding cases. There is a comparative absence of hemorrhagic pigmentation. These areas are composed of a series of smaller areas in which there is a marked rarefaction of the cortex. In the subcortex there are rather extensive areas surrounding the blood-vessels, in which there is an absence of the neuroglia reticulum, the space being filled with red blood corpuscles, small mononuclear cells, and proliferated neuroglia cells. An area 3 by 1 cm. of subcortical softening independent of the other areas, is present in one of the sections. Several capillary blood-vessels run through this area and are apparently normal. The neuroglia network and ganglion-cells of the cortex within this area have entirely disappeared. The neuroglia-cells are markedly proliferated and contain large quantities of the hemorrhagic pigment. The rest of the central nervous system shows nothing abnormal with the exception of a few capillary hemorrhages beneath the surface of the fourth ventricle of the pons and the medulla.

A study of the clinical records of the above cases gives unsatisfactory results. In only one of the cases was there evidence of distinct disturbance of cerebral function. Case No. 2676 presented a clinical picture of a delusional type of insanity with systematized delusions of persecution, marked egotism, loss of memory, etc. There was no previous history of mental disease, and the mental disturbance devel-

oped while the patient was under observation. In another case, No. 3142, there was a very marked change in the mental condition while under observation. Although this could not be considered as an insane state, it was a distinctly pathological mental condition. Inasmuch as the same mental condition is present without cortical softening, there is no reason why the one should be considered as a result of the other. The only conclusion that can be deduced from the study of these four cases is that there is a type of cerebral cortical softening secondary to a localized tuberculous inflammatory lesion of the meninges.

DISCUSSION ON DR. McCARTHY'S PAPER

Dr. Lawrence F. Flick, Philadelphia: I do not feel competent to discuss the paper from a pathological point of view, but I would like to say a word from the sociological side and perhaps from the clinical side. I could not help thinking while the author was reading his paper that perhaps it is a misfortune that the subjects touched upon in this paper must be discussed in separate sections, for I believe it would be more advantageous to discuss them at the same time from all points of view.

The influence of tuberculosis upon the nervous system has up to the present not been given sufficient consideration, particularly from the broad point of view of sociology. Perhaps with fuller knowledge of what tuberculosis does to the nervous system we may better understand the part which tuberculosis plays in the development of insanity and nervous conditions of various kinds. I rise to call attention to this side of the problem, so that we may not lose sight of it in our discussion.

Dr. William H. Welch, Baltimore: While I was much interested in Dr. McCarthy's paper, I was unfortunate in not hearing the beginning of it. It is important that we should recognize the diversity of symptoms in tuberculous meningitis. It has been pictured too much as a uniform disease, anatomically and clinically, in the text-books. There is no question about the occurrence of these localized forms of tuberculous meningitis. Of course, they are not the rule but the exceptions. Dr. McCarthy stated that the cerebral forms of tuberculous meningitis usually occurred as independent affections; but it has been my experience in most cases of diffuse cerebral meningitis to have the spinal form with it, truly a case of cerebrospinal meningitis. It was pointed

out many years ago that if you examine the spinal cord in these cases of diffuse cerebral meningitis you will find tuberculosis without sometimes much exudate in the cord, particularly posteriorly. I wish to emphasize the point that this is a true cerebrospinal affection. I do not know a place anywhere in the body which offers a better opportunity to study the various forms of the specific manifestations of the tubercle bacillus than here, varying according to the intensity of the process, the duration of the process, etc., but particularly because of the relative simplicity of the structures or textures. You will find cases without exudate and miliary tubercles, cases you could hardly call tuberculous meningitis, better called tuberculosis of the meninges with scarcely any exudate. On the other hand, there are cases that require some skill to recognize the tuberculous process at all.

There is another form of tuberculosis in which you have nothing but a diffuse exudate, with here and there patches of caseation. Spread over the brain is a fibro-purulent exudate, rich in fibrin and polymorphonuclear leucocytes without any large epithelioid cells. Here and there will be found little patches of nuclear fragmentation and caseation which will indicate the condition. These exudates may be of all grades. They represent the very acute cases; the others represent the chronic cases. The intermittent (intermediate) or ordinary type is distinguished by the presence of perivascular tuberculosis and a large number of proliferating cells of epithelioid type. It is extremely interesting to study these manifestations, and how to explain them is an open question. Whether the variations depend upon the ways the bacilli get in, or in the varying virulence of the bacilli, or the resistence of the individual is, of course, a matter purely of speculation, similar to conditions occurring in other parts of the body.

Dr. Dunning S. Wilson, Louisville, Ky.: I did not have the pleasure of hearing all the paper read. I am particularly interested in the diagnosis of these cases, as it is of great moment to decide just what the cerebral condition is in these pulmonary cases.

In connection with this I should like to call attention to the difficulties encountered in diagnosis. A meningeal tuberculosis is often of this character where there is a breaking down or caseation in the lungs without the presence of the tubercle bacilli. I remember, weeks ago, a case getting along nicely, when the patient suddenly developed a headache. My intuition was that he was developing a tubercular abscess in one of the silent areas. A consultant questioned my diagnosis.

In ten days strabismus appeared and there was no question of my diagnosis. At the post mortem an abscess was found in the right prefrontal lobe. There were no motor symptoms. The meningitis had spread along the right parietal meninges and finally reached the posterior portion of the brain.

These cases are very obscure and all are worth while studying at the autopsy, so that when such conditions present themselves we can make the diagnosis early and so be ready to prognose the unfortunate endings which almost always follow such complications.

Dr. Alfred Meyer, New York: All of us whose practices are not limited to one special field must agree with Dr. Flick, that it is a pity that this subject cannot be discussed at a joint meeting.

To me the diagnosis of the process is perhaps foremost, perhaps so because I want to refer to the cases reported by Dr. McCarthy in which the question of diagnosis came up, the question of diagnosis between uremia, or possibly tuberculosis of the brain of one or the other type. I should like to report our experiences at the Mt. Sinai Hospital with lumbar puncture, in which in every single case the presence of tubercle bacilli in typical morphological form was obtained in these tubercular cases by this method, *i. e.*, by lumbar puncture alone, performed with unusual faithfulness of examination of the fluid taken by puncture. The figures gone over during the last few months showed that 100 per cent. of the cases were confirmed microscopically, the cases numbering seventeen. The faithfulness in examination is evident when I tell you that one examination required five or six hours. The method employed has been called the fractional centrifuge method. In this we get centrifugation. In other words, in every single one of those seventeen cases, after an examination that lasted sometimes five or six hours, positive proof bacteriologically was made. This should be borne in mind in those institutions where a diagnosis only presumptive could be made positive and scientific.

Dr. Agnes C. Vietor, Boston: I should like to know if I understood Dr. Welch to say that meningitis was always the predominant affection, *i. e.*, not a complication of pulmonary tuberculosis? If I did understand him correctly, I should like to ask him what pathological data there are to explain the not infrequent occurrence of cerebral symptoms late in cases of pulmonary tuberculosis.

Dr. William H. Welch, Baltimore: I do not think that I referred to that point at all. It is well known, however, that tuberculous menin-

gitis occurs chiefly in young children and infants without any manifestations of pulmonary tuberculosis. In some cases you have to search a long time before you find any localized foci in the body. The cerebral symptoms of phthisis are due to the accompanying tuberculous meningitis.

Dr. D. J. McCarthy; Philadelphia: In discussing the relative frequency of the different types of tuberculous meningitis, the point of my paper was that where the infection occurred in childhood, during a simple tuberculous process, the miliary type of meningitis was most frequently met with, and while this type of meningitis is not infrequently met with in adults, when the meningitis complicates advanced pulmonary tuberculosis with mixed infections, a mixed septic type of tuberculous meningitis results; that a mixed streptococcic and pneumococcic infection is a determining factor with the development of the meningitis which would not otherwise occur. The course, symptomatology and pathology of this latter type of meningitis is somewhat different from miliary tuberculosis of the meninges.

In reference to the occurrence of headaches during the course of pulmonary tuberculosis, an investigation at the Henry Phipps Institute showed that they were most frequently due to eye-strain. The eye muscles share in the general muscle weakness of the patient. These patients must by necessity lead a sedentary life, and are prone to overuse the eyes for reading, sewing and other work, and headaches as a natural consequence are to be expected. While headache is an important symptom of tuberculous meningitis, it is more often due to other conditions. Persistent headache may be an only manifestation of a subacute leptomeningeal process; if this, however, be extensive, other symptoms such as the Babinski sign, some loss of power together with alteration of reflexes may be noted.

In reference to insane states in tuberculosis, the distinct causal relationship between the two conditions may be established in a certain group of cases. In these cases, gross organic lesions of the brain may be observed. The general weakness of patients suffering with advanced tuberculosis and wasting of the brain substance, the edema, the internal hydrocephalus and local chronic inflammatory processes lead to mental disturbance. The proportion of insanity in tuberculosis, is therefore higher than that of people not suffering with this disease.

The relationship of criminality to tuberculosis is not a matter easy of determination. Until proper precautions are taken in places of deten-

tion for criminals, to prevent infection, it will be impossible to determine what this association means.

Lumbar puncture is a valuable means of diagnosing tuberculous meningitis, but I am not sure that the presence of tubercle bacilli in the cerebrospinal fluid is pathognomonic of tuberculosis of the meninges. In advanced cases of pulmonary tuberculosis where a tuberculous bacteremia occurs, and where tubercle bacilli are present in the urine and other secretions, it would not be at all surprising to find tubercle bacilli in the cerebrospinal fluid without active tuberculosis of the meninges.

With a careful technique, tubercle bacilli should be found in the cerebro-spinal fluid of all cases of tuberculous meningitis. Dr. C. Y. White reports to me that he has found them in all cases which have been controlled by autopsy. If proper care be taken of the cerebro-spinal fluid after its removal, a fine fibrin reticulum forms, holding the tubercle bacilli in its meshes. If this be carefully removed, placed on slides, fixed and stained in the usual manner, there will be no difficulty in detecting the tubercle bacilli.

THE LIVER IN TUBERCULOSIS

By Josephus T. Ullom, M.D.

Philadelphia

History.—Tuberculosis of the liver was considered a very rare manifestation by the older observers. Louis[1] in 1843 found it in only two of one hundred and twenty cases of pulmonary tuberculosis. Forster[2] in 1854 found it in only three in a great many cases examined. Bristowe[3] in 1858 found, in an examination of livers relative to the frequency of liver abscess following intestinal ulceration, that, in one hundred and sixty-seven cases of tuberculous ulceration of the intestines, there were but twelve cases of tuberculous "*cavities*" in the liver. Waldenberg[4] in 1869 reports that it is the organ most frequently affected in experimental tuberculosis, but this is probably due to the mode of infection, as the infective material is usually thrown into the peritoneal cavity and the susceptibility of the liver in various animals would also be a determining factor.

As we come nearer to the present time we find that, owing to the more careful and searching examinations, particularly by means of the microscope, the lesions of tuberculosis in the liver are more frequently found.

Arnold[5] in 1880 considers it an almost constant factor in cases of tuberculosis. Simmonds[6] in 1888 found it in 76 per cent. in adults, 92 per cent. in children, and 78 per cent. in general.

Zehden[7] in 1897 found miliary tubercles in 50 per cent. of fatal cases of pulmonary tuberculosis, corresponding with the frequency of intestinal ulceration. Rolleston[8] in 1903 thinks it occurs in less than 50 per cent. of cases.

[1] Louis, "Recherches sur la phthisie," Paris, 1843.
[2] Forster, "Handbuch der spec. pathologisch Anatomie," 1854.
[3] Bristowe, *Transactions British Path. Soc.*, Vol. IX, 1858, p. 241.
[4] Waldenberg, "Die Tuberculose," Berlin, 1869.
[5] Arnold, *Virchow's Archiv*, Bd. LXXXII, 1880.
[6] Simmonds, *Deutsches Archiv für klin. Med.*, 1888.
[7] Zehden, *Centralblatt für path. Anat.*, Vol. VIII, 1897.
[8] Rolleston, "Diseases of the Liver."

PATHOLOGICAL SECTION

We report only thirty-seven cases, as the work was not undertaken until mid-year, and we were unable to obtain the livers of the cases previously autopsied. In our series, comprising thirty-seven cases, we found tubercles thirty times, or a trifle over 81 per cent. Of these thirty livers, nine had atypical lesions, the tubercles lacking the giant-cells, but showing round-cells, epithelioid cells, and caseation. In the remaining twenty-one cases the lesions were atypical.

That typical tubercles would have been found in every one of the thirty cases is probable had sections enough been made. A great many sections were made of each liver, and in a number of instances the first sections showed atypical lesions, while later specimens gave the characteristic picture, including the giant-cell.

All the livers were stained for tubercle bacilli, and the bacteria were found in six cases. In three cases they were present in large numbers, two of these being cases of miliary tuberculosis, and the third containing miliary tubercles and caseous nodules, and on the periphery of the latter bacilli were found. In the other three cases only two or three bacilli were found, but they were characteristic. The infrequency of this finding was surprising, but many observers have had the same experience. Baumgarten[1] found them infrequently in experimental tuberculosis, and Brissard and Loupet,[2] Hanot and Lauth,[3] Wessner and Koeckel,[4] found them very rarely.

Clinical Recognition.—Fraenkel[5] in 1882 published four cases, in all of which he diagnosed hepatic tuberculosis clinically and it was confirmed at autopsy. One was a case of chronic pulmonary tuberculosis, one was a case of caseous pneumonia, and the remaining two were cases with typhoidal symptoms in which a diagnosis of acute miliary tuberculosis was made. The diagnoses in these cases were made on jaundice, tenderness over the liver, and enlargement. Fraenkel thinks that in cases of chronic pulmonary tuberculosis or in cases with typhoidal symptoms the appearance of jaundice, especially when accompanied by tenderness over the liver and hepatic enlargement, is a sufficient ground for a diagnosis of tuberculosis of the liver.

MacKenzie[6] in 1890 reports a case of chronic phthisis in which there

[1] Baumgarten, *Zeitschrift für klinische Med.*, Bd. IX and X.
[2] Brissard and Loupet, "Etudes exp. sous la direct. du prof. Verneuil, I, Paris, 1887.
[3] Hanot and Lauth, "Etudes exp. sous la direct. du prof. Verneuil," II, Paris, 1888.
[4] Koeckel, *Virchow's Archiv*, Bd. CXLIII, 1896.
[5] Fraenkel, *Zeitschrift für klin. Med.*, Bd. V, 1880.
[6] MacKenzie, *British Path. Soc.*, 1890.

was clinically pain in the hepatic region and the organ was enlarged an inch below the costal margin. At autopsy a huge cavity was found in the right lobe of the liver, which was shrunken. This cavity contained some pultaceous matter and was defined in part by a fibrous capsule and in part by liver substance.

Waring[1] speaks of tuberculous abscesses of the liver, but says they are without clinical manifestation.

Ransohoff[2] reports a case of tuberculoma of the liver which was palpable through the abdominal wall and which was removed by operation. In this case the patient had previously had a testicle removed for tuberculous disease, and although the tumor did not show tubercle bacilli, it was diagnosed a tuberculoma. Wagner[3] never saw jaundice associated with cases of tuberculosis. He found enlargement of the liver and tenderness in the hepatic region characteristic of tuberculosis and especially of acute miliary tuberculosis.

Zehden thinks that the clinical manifestations of hepatic tuberculosis amount to nothing, as he has seen no case of jaundice in two hundred and twenty-five cases of phthisis autopsied.

He discusses at some length the cases of Fraenkel and his diagnosis of them. Fraenkel thought the jaundice in one of his cases was hematogenous, analogous to the jaundice of the acute infections, but was not at all convinced that it was so, as the presence of jaundice is so rare in acute tuberculosis.

He also suggests that it may be due to a fibrous hepatitis whose advent is coincident with that of the miliary tubercles and which is of a tuberculous nature. He discusses the possibility of an obstruction of some of the finer bile-ducts by the miliary tubercles, but does not think this occurs.

Zehden does not believe in hematogenous origin for the jaundice, neither does he think it is the result of a fibrous hepatitis, and he is extremely skeptical in regard to the possibility of recognizing hepatic tuberculosis by clinical signs.

Rolleston thinks that it is impossible to diagnose tuberculosis of the liver with any degree of certainty, and thinks, with the majority of other observers, that clinical symptoms are rare.

In our series jaundice was present twice in thirty-seven cases. In

[1] Waring, "Diseases of the Liver."
[2] *Medical News*, April, 1904.
[3] Wagner, *Deutches Archiv für klin. Med.*, Bd. XXXIV, 1884.

one case (No. 2252) slight jaundice was noted one month before death and no further observations about it are made in the record, so we are bound to conclude that it lasted but a short time. There was in this case associated enlargement of the liver to two finger-breadths below the costal margin, and also marked tenderness, but a diagnosis of hepatic tuberculosis was not made.

At autopsy miliary tubercles were found associated with a marked degree of congestion, and it is to this latter rather than to the former that we are inclined to look for an explanation of the tenderness and increase in size.

In the other case (No. 2662) jaundice came on about one month before death and persisted. In this case jaundice was marked and was associated with enlargement of the liver, presence of bile in the urine, and clay-colored stools.

Autopsy revealed a moderately enlarged liver containing yellowish-white nodules, varying in size from a pin-head to a pea, scattered throughout the liver, which were apparently tubercles. Microscopically these proved to be caseous areas surrounded by small round-cells and epithelioid cells, and tubercle bacilli were found on their periphery. There were also typical miliary tubercles seen.

In none of our other cases was there jaundice. In six of our cases there was tenderness over the liver. One of these was No. 2582 in our series, a child seven years old, in whom there was hepatic enlargement, and the liver showed microscopically tubercles in the periportal spaces. One was case No. 1577, which showed marked amyloid change and typical tubercles. One was case No. 2252, which showed marked congestion and typical tubercles.

Of the other three, two showed mitral stenosis (cases No. 2701 and No. 2180) and the third (case No. 2446) showed a systolic murmur at the apex and at the aortic cartilage, and, as there was coincident enlargement of the liver in two of these cases, it would be logical to attribute the pain and tenderness to passive congestion the result of the cardiac condition.

Enlargement of the liver was charted in twelve cases of the thirty-seven, and in three of these moderate congestion and typical tubercles were found, two showed moderate congestion and a marked degree of fatty change associated with typical tubercles, two showed moderate congestion and atypical tubercles, one showed moderate congestion and no tubercles, one showed a marked degree of amyloid change asso-

ciated with tubercles, one showed moderate congestion, typical tubercles in the periportal spaces associated with the formation of new bile-ducts, one showed a great number of large caseous areas surrounded by small round-cells and associated miliary tubercles, and one showed miliary tubercles alone.

In only three of these cases would it have been possible to have made a diagnosis of hepatic tuberculosis clinically according to the autopsy findings, as there were only three specimens in which there was not an associated condition to which we would be more apt to refer the enlargement. From a consideration of the clinical and pathological findings in these cases and from a perusal of the reports of other observers it must be concluded that a clinical recognition of hepatic tuberculosis is rarely if ever justified. In those cases in which jaundice has occurred we have been unable to say how it was caused, or, indeed, to say that it was due to the tuberculous process, while tenderness and enlargement are more apt to arise from other causes, namely, fatty change and passive congestion.

Mode of Infection.—The infection may take place in utero, as witness a case reported by Sabouraud and referred to by Zehden, in which there was miliary tuberculosis of the liver and spleen in an infant eleven days old, in whose mother there was phthisis pulmonalis but no genital or mammary tuberculosis. He concluded that the infection traveled by way of the umbilical vein. Nocard, according to Zehden, also reports a case of liver tuberculosis in a calf in whose mother's placental cotyledons there were tubercles containing giant-cells.

Von Honl[1] found tuberculosis in the liver and other organs in a fifteen-day-old child in which the tubercles undoubtedly antedated birth. His reason for believing that they were older than fifteen days was the amount of fibrous change that had taken place around the lesions.

In the adult liver it is possible that the infection travels by way of the blood-vessels. Simmonds,[2] however, does not accept this opinion. He claims that the infection travels by way of the bile-ducts, coming from the duodenum, traverses and pierces the wall of the duct without injuring that structure (as it has been proved to do through other normal membranes, as the intestine), and sets up its characteristic lesion in the parenchyma. The tubercle involves the bile-duct by ex-

[1] Von Honl, "Acad. des Sciences de l'empereur Franz Joseph I," Bulletin International Prague, 1895.
[2] Simmonds, *Centralblatt für allgemeine Path.*, November, 1898.

tension, breaks through the wall of that structure, and the caseous, broken-down tissue forming its center is extruded into the bile-duct and in this way reinfects it. He considers the so-called bile-duct tubercles as analogous to caseous peribronchitis.

Orth, according to Kotlar,[3] thinks that the infection travels from the portal vein by way of the lymph-channels.

Sabouraud, according to the same author, considering only the so-called bile-duct tubercles, thinks that the infection comes, not by way of the bile-ducts, but by way of the blood; that the bile-ducts are very resistant to the tuberculous process and are the last structures to be involved.

Kotlar himself made very careful examinations of tuberculous livers, histologically and bacteriologically, and came to the conclusion that the infection is hematogenous and does not come by the bile-ducts.

Zehden agrees with Kotlar, and goes further: He states that the infection in chronic and in acute tuberculosis is by different channels. In chronic tuberculosis it travels by the arteries and in acute by the veins. He thinks the initial foci are in the tissue supplied by the smallest blood-vessels, and that thence the infection is carried by the lymph-stream. The smallest vessels in the liver are in the intermediate zone of the acini, and it is here that the bacilli are apt to lodge and set up the lesion.

Klebs, according to Zehden, believes the infection in chronic tuberculosis begins in the middle zone of the acini and spreads peripherally via the lymph-channels. He believes that the infection can travel against the lymph-stream.

Kotlar shows rather conclusively that the infection does not take place via the bile-ducts. He was never able to find the tubercle bacilli in bile.

Letienne, quoted by Kotlar, found tubercle bacilli in the bile only once in twelve cases. In careful sections of the tuberculous livers Kotlar found these so-called bile-duct tubercles, where the tubercle had broken into the bile-duct and the tubercle was bile-stained, but he was unable to find giant-cells or false giant-cells in the walls of the ducts. He thinks the growth of the tubercle gradually involves the wall of the bile-duct by extension from the parenchyma.

In our cases an attempt was made to classify the tubercles according to the position they occupied in the parenchyma. Of the thirty cases

[3] Kotlar, *Zeitschrift für Heilkunde*, Bd. IV, 1894.

in which tubercles were found, eleven were found to be intra-acinal, ten were periportal, and in nine cases the tubercles were both intra-acinal and periportal. In two cases of acute miliary tuberculosis they occupied both positions. In no case was there found a rupture into the bile-duct.

Varieties.—1. The miliary tubercle is the most common variety found in the liver, and all our cases but one were of this type.

2. The so-called bile-duct tubercle. In this affection, according to Zehden and Rolleston, the bile-ducts are surrounded by caseous masses which have broken through the wall of the duct, and the caseous material occupying the center of the tubercle may be bile-stained or possibly blood-stained from hemorrhage, or if the caseous material has been extruded into the duct, the resulting cavity may be bile-stained or blood-stained.

Kotlar and Zehden think that the name bile-duct tubercle is a misnomer, as they consider the infection a hematogenous one, and think the duct is only secondarily involved by extension. The cavity formed by the expulsion of the caseous material into the duct has usually a capsule composed of the fibrous tissue surrounding the portal spaces, and the cavity is surrounded by a caseating area.

The caseating areas are usually one-sixth to one-fourth of an inch in diameter. The cavities may attain considerable size and may measure one to two inches in diameter. The ducts outside the liver substance—the hepatic, the cystic, and the common duct—are rarely involved, according to Rolleston, although sometimes the glands adjacent to those ducts are. Koester[1] reports the case of a boy who had jaundice due to the pressure of the glands on the common duct. In this case the boy had a tuberculous pneumonia and the liver showed miliary tubercles.

3. Solitary tubercle. According to Rolleston, this variety consists of large masses which are not found in the periportal spaces. It is very common in some animals. In 20 per cent. it is the only organ affected in birds. In bovines also large masses are found in the liver. This form of tuberculosis is frequently found in the liver of the monkey. It is very rare in human beings, but less rare in children than in adults.

This same author (Rolleston) reports a case in a boy of eight. Large masses were felt in the liver during life. He was admitted to

[1] Koester, *Centralblatt für innere Medicine*, 1896.

the hospital with pericarditis and renal disease, and developed tuberculous foci of the limbs, skull, and vertebræ. The large masses in the liver were unstained with bile.

Moore reports a case in which there was cancer of the stomach, and large masses developed in the liver, the supposition being that the absence of hydrochloric acid from the stomach and the ulcerated surface in that organ presented a combination especially fitting for the entrance of the tubercle bacillus. Clement[1] describes an almost similar case.

These solitary masses are easily enucleated and resemble gummata. The masses may soften and produce abscess-like areas.

4. *Conglomerate Tubercle.*—This variety is very rare. Orth[2] reports two cases, in one of which the patient had miliary tuberculosis and also a large caseous nodule in the liver. Microscopic examinations were not made, but Orth thinks there was no doubt as to the diagnosis. Zehden and Simmonds both attack his diagnosis and think is was probably a gumma, with coincident miliary tuberculosis. In his second case there was a similar condition. There was in this case a caseous nodule as large as a hen's egg in a liver in which there were miliary tubercles. Simmonds and Zehden both dispute the correctness of this diagnosis, and think he was dealing either with a gumma or a cancer with a coëxisting miliary tuberculosis.

Simmonds publishes two cases, in one of which there was a spondylitis, tuberculous pericarditis and pleuritis, and a nodule the size of a hen's egg in the liver. There were tubercles in the liver and no involvement of the bile-ducts, the liver vessels, or the gastro-intestinal canal. Microscopically a structureless mass was found, in whose center were the remains of giant-cells.

In his second case, pea-sized to goose-egg nodules were found with caseous centers. They were sharply defined from the surrounding structures. Microscopically giant-cells and tubercle bacilli were found. The second case was notable for the amount of destruction which had taken place.

Coincident Pathological Processes.—1. Amyloid degeneration. This is a more or less frequent occurrence in chronic tuberculosis, not only of the lungs, but also of the bones. In our thirty-seven cases it appeared but four times, or in about 11 per cent. Two cases were well marked and the other two showed it only in a slight degree.

[1] Clement, *Virchow's Archiv*, Bd. CXXXIX, S. 35.
[2] Orth, *Virchow's Archiv*, Bd. LXVI, 1871.

2. Fatty change in the liver has been the subject of much discussion. Langerhans thinks it is due to a paralysis of the hepatic cells and that the fat physiologically stored there is not given up. Klebs thinks it is the direct result of the tuberculous process on the lymphatic apparatus of the liver, the lymph outflow being hindered and the fat retained.

In our series it occurred in nine cases out of thirty-seven, or about 24 per cent. In the cases examined it was impossible to determine the cause.

Congestion.—The occurrence of congestion in the liver is, of course, not characteristic of this disease, and yet it is an almost constant finding.

In chronic lung disease the embarrassed respiratory apparatus with its effect upon the right heart sooner or later gives rise to passive congestion. The liver, with its close proximity and its blood-supply, is one of the first organs to show the change.

In our cases we classified the congestion as slight, moderate, and marked. There were eight cases of slight congestion, twenty-three in which it was moderate, and four in which it was very marked. Only two showed an absence of congestion.

Cirrhosis.—Cirrhosis of the liver may accompany tuberculosis and be due to an entirely independent cause. For instance, we may have an alcoholic cirrhosis, superimposed upon a tuberculous infection. We may also have cirrhosis of the liver with tuberculosis elsewhere in the body, but it has long been felt that there was a fibrous hepatitis due to the tubercle bacillus. Briege[1] in 1879 described a fibrous hepatitis occurring in tuberculous patients, with the formation of fibrous tissue which inclosed the lobules, together with newly formed bile-ducts. Arnold also speaks of newly formed bile-ducts.

Rolleston discusses at length cirrhosis of the liver associated with tuberculosis. He quotes Hanot and Gilbert, who describe a large fatty liver with a small-cell infiltration and fibrous hyperplasia of the portal spaces, together with miliary tubercles. This they call "hypertrophic fatty tuberculous hepatitis."

These authors describe two other forms: (*a*) Cirrhosis without any enlargement of the liver. (*b*) Cirrhosis with more fibrous tissue than the variety just mentioned—that is, cirrhosis without enlargement of the liver—but with similar fatty change, and tuberculous infiltration. The two latter forms differ only in the fact that one shows marked

[1] Briege, *Virchow's Archiv*, Bd. LXXV, 1879.

nodules, like those seen in cirrhosis with adenomata. Rolleston thinks these forms occur, but he does not think them tuberculous. He considers it reasonable to suppose the tubercle bacillus capable of a sclerogenic effect in the liver.

In animals, as in guinea-pigs, Hanot and Gilbert were able to produce a cirrhosis of the liver by the injection of avian tubercle bacilli; while human bacilli produced fatty change or coagulation necrosis. Hanot found a deeply scarred liver, like that of acquired syphilis, associated with miliary tubercles in the organ.

Collet and Gallivardin, according to Rolleston, report a case of tuberculosis of the portal spaces with a delicate fibrosis accompanying.

Mixed infection, according to Rolleston, may set up a gastritis and a consequent dyspeptic type of cirrhosis. A marked grade of passive congestion may set up a cirrhosis—the so-called cardiac cirrhosis.

In seven of our cases we found newly formed bile-ducts, but in only one of the seven was there coincident increase of fibrous tissue, and in this case the increase was but slight. This was case No. 2662, in which there were marked jaundice and enlargement of the liver clinically and the physical signs gave evidence of cavity formation in the lungs.

At autopsy the liver was found enlarged, weighing 1950 gm.; it was denser than normal and the edges were rounded. On section small, yellowish-white nodules were seen scattered throughout the organ. These nodules were from pin-head to pea size. Some of them seemed to be coalesced. The gall-bladder was distended and the bile-duct patulous.

Microscopically there were large caseous areas in the liver without giant-cells, but there were tubercle bacilli in these areas, and there were typical miliary tubercles with giant-cells. There was also a slight increase in the amount of fibrous tissue, there being prolongation of fibrous tissue from about the branches of the portal vein. This was not marked, and there was nowhere a definition of a lobule by the fibrous tissue. There were also newly formed bile-ducts. In the other six cases in which there were newly formed bile-ducts there was no increase of fibrous tissue.

In only three cases was there increase of fibrous tissue, case No. 2662, just described, and cases Nos. 2899 and 3010.

Case No. 2899 showed a moderate increase of fibrous tissue, the fibrous tissue extending from about the portal vein between the hepatic cells and giving the appearance of tendrils or processes of the peri-

portal fibrous tissue. Nothing abnormal in the liver was found clinically, and at autopsy it was described as firm and containing whitish areas, of which some were coalesced. There were typical tubercles found microscopically, and no newly formed bile-ducts. There was in one place an inclusion of hepatic cells by the fibrous tissue, but the area was very small and the cells seemed normal.

Case No. 3010 showed clinically slight enlargement, but no tenderness, and was diagnosed as cirrhosis of the liver. From macroscopic appearance fatty cirrhosis and acute miliary tuberculosis were recorded at autopsy. Microscopically miliary tubercles showing tubercle bacilli were found, and there was a slight increase in the amount of fibrous tissue, there being prolongations of the periportal fibrous tissue between the hepatic cells.

In none of these three cases was the increase of fibrous tissue decided, but it was sufficient to be very interesting and to give rise to speculation as to its origin. In case No. 2662 there was a history of alcoholism, and although the patient denied specific infection, there was reasonable doubt in the mind of the examiner as to the truth of this statement. Case No. 2899 had no alcoholic or specific history, but case No. 3010 had always been a very hard drinker and had had syphilis.

With a very pronounced alcoholism in two cases we should not hesitate to ascribe whatever fibrous change had taken place in the liver to alcohol rather than to the tuberculous process. In case No. 2899, in which there was no history of alcoholism or of syphilis, there is a possibility that the fibrosis was due to the tubercle bacillus, yet we hesitate to state that it is more than a possibility.

In conclusion we may say: 1. That tuberculosis of the liver is found in a large percentage of cases dying of pulmonary tuberculosis.

2. That its clinical recognition is only rarely, if ever, possible.

3. That the infection probably takes place by the blood-vessels, the bacilli being carried to the liver by the portal vein or the hepatic artery.

4. That passive congestion of the liver is found in nearly every case of pulmonary tuberculosis, while amyloid and fatty change are found in a relatively small number of cases.

5. From our cases we are not convinced that a fibrosis or cirrhosis of the liver due to the tubercle bacillus does occur, and are more inclined to think that the fibroses found are due to other etiological factors.

Clinical Symptoms

	Number Found	
Cases in which jaundice was present	No. 2252, No. 2662	2
Cases in which there was tenderness over the liver	No. 2252, No. 1577, No. 2582, No. 2701, No. 2180, No. 2446	6

Tubercles in the Liver

Case in which tubercle bacilli were found	No. 2582 only a few. No. 2668 large numbers. No. 714 only a few. No. 232 only a few. No. 2662 large numbers. No. 3010 large numbers.	
Cases in which the tubercles were typical	No. 2252, No. 2356, No. 1577, No. 2564, No. 2582, No. 2668, No. 501, No. 1032, No. 2538, No. 2657, N. 3010, No. 714, No. 232, No. 236, No. 2662, No. 2446, No. 2602, No. 2180, No. 2815, No. 2796, No. 2856	21
Case in which the tubercles were atypical, lacking the giant-cells	No. 1157, No. 2102, No. 2701, No. 2494, No. 2596, No. 2787, No. 2899, No. 2821, No. 2855	9
Cases in which no tubercles were found	No. 2046, No. 282, No. 2576, No. 2689, No. 2716, No. 551, No. 2926	7
		37

Location of Tubercles

Cases in which the tubercles were intra-acinal	No. 2252, No. 1577, No. 714, No. 232, No. 2662, No. 2602, No. 2815, No. 2494, No. 2787, No. 2899, No. 2855	9
Cases in which the tubercles were periportal	No. 1157, No. 2582, No. 2564, No. 2102, No. 2538, No. 2701, No. 2180, No. 236, No. 2796, No. 2821	10
Cases in which the tubercles were both periportal and intra-acinal	No. 2356, No. 2668, No. 501, No. 1032, No. 2657, No. 2446, No. 2596, No. 2856, No. 3010	11

Microscopic Findings in Enlargement

Cases in which the liver was enlarged clinically, 12....

- No. 2356, No. 2180 — Typical miliary tubercles, fatty change, moderate congestion.
- No. 2252, No. 2538, No. 2602 — Typical miliary tubercles and moderate congestion.
- No. 2787, No. 2821 — Atypical miliary tubercles and moderate congestion.
- No. 2716 — Moderate congestion and no tubercles.
- No. 1577 — Typical miliary tubercles, marked degree of amyloid, moderate congestion.
- No. 2582 — Typical miliary tubercles, newly formed bile-ducts, and slight congestion.
- No. 2662 — Numerous caseous areas surrounded by small round-cells. Typical miliary tubercles also seen.
- No. 3010 — Typical miliary tubercles, increased fibrous tissue.

Congestion of Liver

Cases showing congestion, 35

- Slight..... 8
  - No. 1577
  - No. 2356
  - No. 2668
  - No. 2102
  - No. 2602
  - No. 2494
  - No. 3010
  - No. 2796
- Moderate..... 23
  - No. 1157
  - No. 2252
  - No. 2046
  - No. 2564
  - No. 282
  - No. 2576
  - No. 501
  - No. 1032
  - No. 2689
  - No. 2538
  - No. 2657
  - No. 2716
  - No. 232
  - No. 236
  - No. 2701
  - No. 2446
  - No. 2180
  - No. 2815
  - No. 2596
  - No. 2787
  - No. 2899
  - No. 2821
  - No. 2856
- Marked..... 4
  - No. 714
  - No. 551
  - No. 2926
  - No. 2855

Cases showing no congestion..... 2
- No. 2582
- No. 2662

PATHOLOGICAL SECTION

Histological Changes

Cases showing amyloid change	No. 1577 No. 2102 No. 236 No. 714	4
Cases showing fatty change	No. 2356 No. 501 No. 1032 No. 2689 No. 2180 No. 2494 No. 2596 No. 2796 No. 2716	9
Cases showing newly formed bile-ducts	No. 2356 No. 2582 No. 501 No. 2538 No. 2662 No. 2494 No. 2796	7
Cases showing increased fibrous tissue	No. 2662 No. 2899 No. 3010	3

CASES

Case No. 1157. Admitted 8, 3, '03. Died 6, 3, '04. Physician, Stanton. Female. White. Widow. Irish. Age, thirty-four. Occupation, housework. Source of infection, husband. Previous diseases, not recorded. Principal symptoms, cough, expectoration, dyspnea on exertion, and hoarseness. Highest weight, not recorded; weight at death, ninety-one and one-quarter pounds. Heart sounds distant and weak. No increase in heart dulness. No increase in size of liver or spleen. Sputum, positive for tubercle bacilli. Urine, 1010, no albumin, no sugar; microscopically, leucocytes and squamous epithelium. Diagnosis, pulmonary and laryngeal tuberculosis.

Pathological diagnosis, Rosenberger: Miliary tuberculosis of both lungs with cavity formation; emphysema and congestion of lungs also present; infarct of left kidney; catarrhal appendicitis.

Liver, weight, one thousand four hundred and twenty-six grams; darker than normal. Consistence, firm. Red atrophy. Microscopic appearance: A marked grade of congestion, so marked that the liver-cells are atrophied in places; two tubercles seen—one is immediately adjacent to the portal vein; it does not involve the wall of the vein; there are no typical giant-cells, but in the center there are the remains of giant-cells; on the periphery there are large numbers of small round-cells and a few epithelioid cells. This tubercle is surrounded by a fairly well-defined capsule of fibrous tissue; the other tubercle found was apparently intra-acinal and contained no giant-cells, but epithelioid and small cells and caseation; no increase of fibrous tissue. No amyloid; tubercle bacilli not found.

Case No. 2252. Admitted 3, 31, '04. Died 6, 24, '04. Physician, Stanton. Male. White. American. Single. Age, twenty. Occupation, laborer and furniture-packer. Both he and his father had been hard drinkers, and his

father had died of phthisis three years before. He had been sick, according to his own account, six weeks, and had been treated in another hospital for typhoid fever. Principal symptoms, slight cough, moderate expectoration of a greenish-yellow color, constipation, night-sweats. His highest weight had been one hundred and sixty pounds; lowest recent weight, one hundred and fifty-five pounds six weeks before admission; weight on admission, not recorded. Heart, diffuse pulsation over whole precordium; second pulmonic accentuated; no murmurs; dulness normal. Liver, extends two finger-breadths below costal margin. Spleen, palpable one and one-half finger-breadths below costal margin. Abdomen, distended. Sputum, tubercle bacilli present. Urine, no albumin, no sugar, diazo present, microscopically, negative. On 5, 4, '04, showed slight jaundice, not pronounced, simply an icteroid hue, marked tenderness over liver; bowels, constipated. On 5, 14, '04 icteroid hue less well marked. Diagnosis, acute miliary tuberculosis.

Pathological diagnosis: Tuberculosis of lungs with cavity formation; miliary tubercles; edema; pneumonia, and bronchiectasis; parenchymatous nephritis; enlarged mesenteric glands; small ulcer in appendix; adhesive pleurisy; fatty liver. Heart, slightly enlarged; valves normal.

Liver, enlarged; edges rounded. Weight, one thousand eight hundred and sixty grams; consistence, firm; color, dark red; no other abnormalities. Microscopic appearance: Marked grade of congestion with distention of the capillaries; a characteristic miliary tubercle with large giant-cell, epithelioid and round-cells, and caseation; this tubercle is not immediately adjacent to a branch of the vena portæ, but apparently started in an intra-acinal position and extended toward the vein; small round-cells on the side of the tubercle nearest the vein, extending in diminishing numbers clear to the vein and involving its wall; no tubercle bacilli were found; no amyloid reaction present.

Case No. 2046. Admitted 6, 7, '04. Died 6, 28, '04. Physician, Hatfield. Male. Colored. Age, thirty-one. Widower; wife died of tuberculosis one year ago. Symptoms date five months back. Principal symptoms, cough, expectoration, dyspnea. Highest weight, one hundred and sixty-eight pounds; lowest, one hundred and forty pounds; weight on admission, one hundrad and thirty-eight and one-half pounds. Heart, normal dulness, no murmurs. Spleen, not enlarged. Liver, not enlarged. Sputum, positive for tubercle bacilli. Urine, 1020, no sugar, trace of albumin, diazo slight. Had a large hemorrhage on the day before death. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of right lung with communicating cavities at right apex laying bare the veins; miliary tubercles in lower lobe; miliary tubercles at left apex; congestion and emphysema present in both lungs; enlarged mesenteric glands and parenchymatous nephritis. Heart is slightly hypertrophied; no valvular lesions.

Liver is slightly enlarged, overlaps stomach from right to left; weight, two thousand two hundred and thirty-two grams. Consistence, firm; color, dark red. Gall-bladder contains quite a quantity of brownish fluid. No calculi. Microscopic examination: Moderate congestion; no tubercles; at one point a small collection of small round-cells and a few interspersed epithelioid cells, apparently the beginning of a tubercle. The collection of cells is immediately adjacent to a branch of the portal vein. There is no caseation and there are no giant-cells. No tubercle bacilli were found, and there was no increase of fibrous tissue nor any newly formed bile-ducts.

PATHOLOGICAL SECTION

Case No. 1577. Admitted 10, 27, '03. Died 7, 11, '04. Physician, McCarthy. Female. Black. Widow. Age, twenty-seven. Occupation, housework. Husband died of phthisis four years before. Previous diseases, pneumonia, malaria seven years before, pertussis, and influenza. Principal symptoms, cough, expectoration, pain and tenderness in chest and in abdomen. Heart, dulness normal; there is a systolic murmur at the apex. Liver, enlarged to the umbilicus, very tender and painful. Large quantity of fluid in the abdomen. Highest weight, one hundred and forty-one pounds; lowest weight before admission, one hundred and five pounds; weight on admission, one hundred and five and three-quarter pounds; weight at death, eighty-eight pounds. Urine, 1018, small quantity of albumin, diazo present; microscopically, granular casts and leucocytes. Sputum, positive for tubercle bacilli. Diagnosis, pulmonary tuberculosis, tuberculus enteritis, peritonitis, appandicitis, pericarditis, fatty liver and hepatoptosis, nephritis and supernumerary ribs.

Pathological diagnosis, R. C. Rosenberger: Left lung shows cavity formation, tuberculous pneumonia, and miliary tubercles; right lung is studded with miliary tubercles; heart, slightly enlarged, pericardium adherent, valves competent, muscle flabby, paler than normal; kidney, parenchymatous nephritis, miliary tubercles; spleen, gives amyloid reaction; ulcers in larynx; tuberculous appendicitis; beginning atheroma of the aorta; supernumerary ribs.

Liver is enlarged, extending from the fifth interspace down to the crest of the ilium; weight, three thousand one hundred and twenty-four grams; is of firm consistence, pale yellow in color; gives amyloid reaction; is adherent to right and left sides; on left overlaps the spleen. Microscopic appearance: Moderate congestion; marked amyloid; the amyloid is rather irregularly distributed, but is generally adjacent to the blood-vessels; there are a number of characteristic tubercles containing epithelioid, small round, and giant-cells and caseation; they are all intra-acinal, and have apparently no connection with the branches of the portal vein.

Case No. 2356. Admitted 5, 6, '04. Died 8, 7, '04. Physician, Walsh. Male. White. American. Single. Aged, thirty-four. Occupation, accountant, manager of a pool-room, machinist. Drank to excess. Probably contracted tuberculosis from his brother. Previous diseases, pneumonia three years ago, varioloid, measles, pertussis, scarlatina, diphtheria, and influenza. Has been ill for three years. Principal symptoms, cough, hemoptysis, expectoration, anorexia, night-sweats. Highest weight, one hundred and sixty-two pounds; ordinary, one hundred and forty-seven pounds; lowest, one hundred and seventeen pounds; on admission, one hundred and seventeen pounds. Heart: it is impossible to outline the heart dulness; the aortic second sound is accentuated. Liver, extends three-quarters of an inch below margin of the ribs. Spleen is normal, apparently. Urine, 1028, no albumin, no sugar, diazo positive, microscopically negative. Diagnosis, tuberculosis of lungs, delirium tremens, passive hyperemia of liver, dilated right heart, phlegmasia alba dolens.

Pathological diagnosis, R. C. Rosenberger: Cavity formation in right lung and caseous pneumonia in both lungs; emphysema; parenchymatous nephritis and tubercles in the kidneys; atheroma of the aorta; enlarged mesenteric glands; heart is normal.

Liver, small; weight, one thousand four hundred and eighty-eight grams; firm, pale; cut section presents a mottled appearance; gall-bladder is one finger-breadth below margin of the liver. Microscopic appearance: Fatty change

moderate amount, found on the periphery of the lobules; moderate congestion; typical tubercles, periportal in position; no amyloid; slight increase of fibrous tissue; few newly formed bile-ducts.

Case No. 2564. Admitted 7, 1, '04. Died 8, 6, '04. Physician, Hatfield. Male. White. Single. Irish. Age, thirty-six. Occupation, freight handler and laborer. Source of contagion, not elicited. Previous disease, pertussis. Principal symptoms, cough, slight expectoration, dyspnea, edema in feet, and constipation. Highest weight, one hundred and forty pounds; lowest recent, one hundred and seven pounds; weight on admission, ninety-three pounds. Heart, enlarged slightly to right and left; both aortic and pulmonic accentuated; soft systolic murmur at apex. Liver, dulness is apparently normal; no tenderness or jaundice or pain. Diagnosis, pulmonary and laryngeal tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Adhesive pleurisy, caseous pneumonia, cavities in both apices, miliary tubercles in both lower lobes, with areas of congestion; heart shows slightly thickened mitral valve, chordæ tendinæ thickened; spleen, normal; kidneys show tubercles; mesenteric glands, enlarged.

Liver, small, weight, one thousand and eighty-five grams, firm, darker than normal; surface slightly granular; edges more or less sharp; red atrophy. Gall-bladder distended, projects below costal margin; duct is patulous. Microscopic appearance: Marked congestion; typical miliary tubercles, with giant-cells; the tubercles are periportal in position.

Case No. 2582. Admitted 7, 6, '04. Died 8, 17, '04. Physician, McCarthy. Male. Black. Single. Native. Age, six. No occupation. Source of contagion, maternal aunt. Previous diseases, measles, five months before. Duration of illness, five months. Principal symptoms, cough, expectoration, dyspnea, constipation, night-sweats. Lowest weight, thirty pounds; highest and ordinary weight, not recorded. Evidence of rachitis in legs and abdomen. Heart, dulness normal; pulmonary second accentuated; no murmurs. Liver, enlarged half-way to umbilicus and is tender. Spleen, enlarged and palpable. Sputum, tubercle bacilli present. Urine, 1030, yellow, trace of albumin, granular casts. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, Joseph Walsh: Tuberculosis of lungs with cavities; miliary tubercles are thickly studded throughout; adhesive pleurisy on both sides; tuberculosis of bronchial, tracheal, and mesenteric lymph-nodes; tubercle in pericardial sac posteriorly; extensive tuberculosis of peritoneum; tuberculosis of spleen and kidneys; heart, apparently normal.

Liver, does not appear enlarged; weight, nine hundred and thirty grams; consistence, normal; color, pale; slightly fatty; contains numerous tubercles. Microscopic appearance: Typical tubercles with giant-cells and a great increase in the number of bile-ducts; the tubercles are periportal in position and are rather diffuse, there being several giant-cells in the neighborhood of the branches of the portal vein; no congestion. There is no amyloid; tubercle bacilli were found.

Case No. 2668. Admitted 8, 9, '04. Died 8, 22, '04. Physician, Norris. Female. Black. Married. Age, twenty-eight. Occupation, house-servant. Source of contagion, not elicited. Previous disease, typhoid fever in 1881. Has been ill for fifteen months. First symptom, glandular enlargement. Symptoms, cough, expectoration, dyspnea, hoarseness, night-sweats, amenorrhea. Highest weight, one hundred and twenty pounds; weight on admission, not recorded.

PATHOLOGICAL SECTION

Heart, dulness extends to midclavicular line; pulmonary sound not accentuated; no murmurs. Liver is not enlarged; no tenderness, pain, or jaundice. Spleen is not enlarged. Sputum, positive for tubercle bacilli. Urine, 1020, acid, trace of albumin, no sugar, diazo positive. Diagnosis, pulmonary tuberculosis; lymphatic and laryngeal tuberculosis; and tuberculosis of the pharyngeal tonsil.

Pathological diagnosis, Joseph Walsh: Miliary tuberculosis of lungs, spleen, kidneys, liver, and suprarenals; ulceration of the intestine; tuberculous peritonitis; tuberculosis of the bronchial, cervical, and mesenteric lymph-glands; parenchymatous nephritis; endometritis and oöphoritis.

Liver, normal size, one thousand eight hundred and sixty-five grams; consistence, normal; color, dark; riddled with miliary tubercles; one calcified tubercle. Microscopic diagnosis: Section is studded with miliary tubercles; some of the tubercles have giant-cells, but most lack them; the tubercles are marked by caseation and there is evidence of calcification in some of them; most of the tubercles are intra-acinal in position, but some are periportal; congestion is moderate; tubercle bacilli are present in large numbers; no amyloid reaction present.

Case No. 282. Admitted 3, 18, '04. Died 8, 24, '04. Physician, Walsh. Male. White. Married. Irish. Age, forty-five. Occupation, laborer. Source of infection, wife. Previous diseases, typhoid, pleurisy, scarlatina. Duration of illness, five years. Principal symptoms, cough, expectoration, dyspnea, diarrhea, edema of feet. Highest weight, one hundred and fifty-nine pounds; lowest weight (recent), one hundred and thirty pounds; weight on admission, one hundred and twenty-three pounds. Liver, normal apparently. Spleen, normal apparently. Sputum, positive for tubercle bacilli. Urine, trace of albumin, granular and hyaline casts; some epithelial cells. Diagnosis, pulmonary tuberculosis with cavity formation; serous effusion on right; myocarditis and dilated right heart; arteriosclerosis.

Pathological diagnosis, Walsh: Tuberculosis of lungs; fibroid condition of both lungs, the right compressed by a pyothorax, the left by a recent pneumothorax; cavities in both apices; obliterative pericarditis; parenchymatous nephritis.

Liver, enlarged; weight, two thousand nine hundred and seventy-six grams; consistence, normal; color, pale; tubercles under capsule. Microscopic appearance: Shows no tubercles; moderate congestion; no amyloid; no increase of fibrous tissue; no tubercle bacilli; no increase of bile-ducts.

Case No. 2576. Admitted 7, 5, '04. Died 9, 1, '04. Physician, Walsh. Male. White. Native. Single. Age, twenty-one years. Occupation, clerk. Non-alcoholic. Source of contagion, not elicited. Previous diseases, typhoid fever, fistulo in ano. Duration of illness, seven years. Principal symptoms, cough, expectoration, dyspnea, chills. Highest weight, one hundred and forty pounds; lowest recent, ninety-five pounds; weight on admission, seventy-four and three-quarter pounds. Heart, slightly enlarged to right and left; slight arteriosclerosis. Liver, normal size; spleen and kidneys, normal. Tenderness over appendix. Sputum, positive for tubercle bacilli. Urine, 1030, no albumin, no sugar, diazo positive. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Cavities in upper lobes; heart, normal; spleen, normal; congestion of kidneys; congestion of liver; enlarged mesenteric glands; tuberculosis of appendix.

Liver, weight, one thousand three hundred and sixty-seven grams; firm consistence; normal color; gall-bladder small and contains a small amount of bile; the duct is patulous. Microscopic diagnosis: Moderate congestion; no tubercle; no amyloid; no increase in bile-ducts; no increase in fibrous tissue.

Case No. 2102. Admitted 9, 5, '04. Died 9, 9, '04. Physician, McCarthy. Male. White. Single. Native. Age, eighteen. Occupation, bookkeeper. No history of alcoholism. No known source of infection. No previous diseases. Has been ill for fifteen months. First symptom, malaise. Principal symptoms, cough, expectoration, dyspnea on exertion, hoarseness. Highest weight, one hundred and thirty-four pounds; lowest recent, one hundred and twenty-five and three-quarter pounds; weight on admission, not recorded. Heart, apparently normal. Spleen, thyroid, and kidney apparently normal. Liver, not enlarged. Sputum, positive of tubercle bacilli. Urine, 1022, albumin, diazo positive. Diagnosis, pulmonary and laryngeal tuberculosis; hemorrhagic purpura.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs with cavity formation and miliary tubercles and emphysema; amyloid spleen; enlarged calcareous mesenteric glands; tuberculous enteritis and appendicitis; laryngeal tuberculosis. Heart, normal.

Liver, amyloid, large, weighs two thousand five hundred and seventy-three grams; firm consistence; normal color; rounded edges. Microscopic appearance: Markedly amyloid; very slight congestion; one atypical tubercle containing round and epithelioid, but no giant-cells; the tubercle is periportal in position; no tubercle bacilli found; no newly formed bile-ducts and no increase of fibrous tissue.

Case No. 501. Admitted 9, 2, '04. Died 9, 10, '04. Physician, Walsh. Male. White. Native. Widower. Age, fifty-three. Occupation, weaver, fireman, miner. Alcoholic. No known exposure to contagion. Previous diseases, typhoid fever, malaria, rheumatism, pleurisy, measles, diphtheria, and influenza. Duration of illness, four years. Principal symptoms, cough, expectoration, hemoptysis, pain in chest, constipation. Highest weight, not known; weight at first visit, one hundred and thirty-seven pounds; weight on admission, seventy pounds. Heart, not enlarged, sounds weak. Liver, normal apparently. Sputum, positive for tubercle bacilli. Urine, 1026, acid, trace of albumin, no sugar, diazo positive, hyaline and granular casts, uric-acid crystals. Diagnosis, pulmonary tuberculosis, emphysema, anthracosis, and arteriosclerosis.

Pathological diagnosis, R. C. Rosenberger: Anthracosis of both lungs; cavities in both lungs and miliary tubercles; fatty liver; interstitial nephritis; mitral endocarditis; pigmentary infiltration of spleen.

Liver, slightly enlarged, weight, one thousand four hundred and eighty-eight grams; firm and mottled. Microscopic appearance: Moderate congestion; fatty change moderate at the periphery of the lobules; typical miliary tubercles containing giant-cells, intra-acinal in position; one seems to be periportal in position; there are a few newly formed bile-ducts; no increase in fibrous tissue; no amyloid.

Case No. 2689. Admitted 9, 2, '04. Died 9, 16, '04. Physician, Stanton. Male. White. Single. Native. Age, thirty-three. Occupation, wood-worker. Contagion from brother and sister. Previous diseases, typhoid fever, malaria, and influenza. Duration of illness, two years. Principal symptoms, cough, expectora-

tion, dyspnea. Highest weight, on hundred and thirty-eight pounds; lowest recent, one hundred and seventeen pounds; weight on admission, one hundred and fourteen and three-quarter pounds. Heart, normal in dulness and sounds. Liver, not felt. Sputum, positive for tubercle bacilli. Urine, albumin present, no sugar, diazo positive; microscopically, a few granular casts. Diagnosis, pulmonary tuberculosis, right-sided pneumothorax, paretic mental type.

Pathological diagnosis, R. C. Rosenberger: Right-sided pneumothorax; tuberculous pneumonia and cavity formation in right lung; edema and congestion of left lung; fatty liver and peritoneal adhesions; pleural adhesions; parenchymatous nephritis; spleen, large; heart, normal.

Liver, enlarged, weighs two thousand four hundred and eighty grams; consistence, fatty; no calculi in gall-bladder; gall-bladder small and empty. Microscopic appearance: No tubercles found; moderate amount of congestion; moderate grade of fatty change found on the periphery of the lobules; no amyloid; no increase of fibrous tissue; no newly formed bile-ducts.

Case No. 1032. Admitted 8, 9, '04. Died 9, 10, '04. Physician, Walsh. Male. White. Single. Native. Age, twenty-seven years. Occupation, coppersmith. Alcoholic. Source of contagion, not elicited. Previous disease, measles. Duration of disease, two years. Principal symptoms, cough, expectoration, pain in chest, dyspnea on exertion, anorexia, occasional chills, frequent night-sweats, diarrhea, and edema. Highest weight, one hundred and forty-five pounds; ordinary, one hundred and thirty-five pounds; lowest recent, one hundred and twenty-five pounds; on admission, one hundred and fifteen pounds. Heart, not charted. Liver, spleen, and kidneys not recorded. Sputum, positive for tubercle bacilli. Urine, no albumin, no sugar, no casts. Diagnosis, pulmonary tuberculosis; tuberculosis of the pleura and intestines.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of the lungs with cavity formation; adhesive pleurisy; fatty kidneys; amyloid spleen.

Liver, small; weight, one thousand one hundred and seventy-eight grams; congested; mottled in appearance; consistence, firm; color, dark red. Microscopic appearance: Typical miliary tubercles with giant-cells; the tubercles are, for the most part, intra-acinal, but one is periportal; moderate congestion; moderate fatty changes seen at the periphery of the lobules; there is a beginning fibrous capsule to a tubercle; no amyloid; no tubercle bacilli; no increase of bile-ducts.

Case No. 2538. Admitted 6, 22, '04. Died 9, 24, '04. Physician, Landis. Female. White. Married. Native. Age, thirty-seven. Mother of four children. Occupation, housework. House probably source of infection. Previous disease, typhoid fever twelve years ago. Duration of disease, fourteen months. Principal symptoms, cough, expectoration, dyspnea on exertion, occasional chills, amenorrhea. Highest weight, one hundred and sixty pounds; ordinary, one hundred and ten pounds; weight on admission, seventy-nine and one-half pounds. Heart, enlarged to left, no murmurs, no accentuation of pulmonic or aortic sounds. Liver, enlarged, is two finger-breadths below the costal margin. Spleen, apparently normal. Thyroid, left lateral lobe enlarged. Kidney, not palpable. Sputum, positive for tubercle bacilli. Urine, 1025, no albumin, no sugar, diazo positive. Diagnosis, tuberculosis of lungs and pharynx.

Pathological diagnosis, R. C. Rosenberger: Lungs contain small cavities and miliary tubercles; congestion of kidneys; cyst of Fallopian tube; tuberculosis of larynx; spleen, slightly enlarged; heart shows fatty infiltration.

Liver, enlarged to level of the umbilicus; weight, one thousand six hundred and twenty grams; normal consistence; normal color; negative for amyloid. Microscopic appearance: Typical tubercles containing giant-cells, periportal in position; numerous areas consisting of a collection of small round-cells are found in the periportal spaces; these areas are not sharply defined, are rather diffuse, and contain newly formed bile-ducts; moderate congestion; no amyloid; no tubercle bacilli found.

Case No. 2657. Admitted 8, 5, '04. Died 9, 20, '04. Physician, Stanton. Male. White. Single. Italian. Age, sixteen. Occupation, gilder. Non-alcoholic. Source of contagion, not elicited. Had influenza in February, 1904. Has been ill for one year. Principal symptoms, cough, expectoration, dyspnea, diarrhea, chills, and sweats. Highest weight, one hundred and twenty pounds; lowest, one hundred pounds; weight on admission, eighty-seven pounds. Liver, spleen, and kidney apparently normal. Heart, apparently normal in dulness and sounds. Four days before death had a petechial eruption on chest and abdomen and a persistent epistaxis and hemorrhage from the bowels. Diagnosis, pulmonary tuberculosis and purpura hæmorrhagica.

Pathological diagnosis, R. C. Rosenberger: Cavities in both lungs and miliary tubercles; pleural adhesions; parenchymatous nephritis; tuberculous enteritis; enterorrhagia; accessory spleen; petechiæ upon skin and in pericardium and pleura; enlarged mesenteric glands.

Liver, small; weight, one thousand two hundred and seventy-one grams; consistence, firm; color, pale; left lobe is thin, tapering, and adherent; edges, rounded. A few small areas resembling miliary tubercles. Microscopic appearance: Slight congestion; typical tubercles containing giant-cells; the tubercles are intro-acinal in position; one tubercle is very close to a large branch of the portal vein, but is not in communication apparently; no amyloid; no increase of fibrous tissue; no newly formed bile-ducts; tubercle bacilli found.

Case No. 714. Admitted 5, 25, '04. Died 9, 27, '04. Physician, Walsh. Male. White. Single. Native. Age, twenty-seven. Occupation, machine operator. Source of infection, unknown. Previous disease, measles. Duration of illness, fifteen months. Principal symptoms, cough, expectoration, dyspnea on exertion, night-sweats. Highest weight, one hundred and forty-five pounds; ordinary, one hundred and forty pounds; lowest, one hundred and twenty-five pounds; weight on admission, one hundred and eleven pounds. Heart, normal in size and position, no arteriosclerosis, second aortic accentuated. Liver, spleen, and kidney not recorded. Sputum, positive for tubercle bacilli. Urine, 1026, no albumin, no sugar, diazo negative; microscopically, negative. Diagnosis, tuberculosis of the lungs with cavity formation, pneumothorax.

Pathological diagnosis, R. C. Rosenberger: Pyopneumothorax; emphysema of right lung, miliary tubercles, and edema; parenchymatous nephritis and tubercles in the kidney; amyloid spleen; congestion of the liver; heart, normal.

Liver, weight, one thousand four hundred and twenty-six grams; consistence, firmer than normal; color, darker than normal; gall-bladder contains 10 c.c. of fluid. Microscopic appearance: Marked degree of congestion, with distention of the capillaries and compression of the liver-cells; slight amount of amyloid; typical tubercles with giant-cells, intra-acinal in position; no increase in bile-ducts; tubercle bacilli found.

PATHOLOGICAL SECTION

Case No. 232. Admitted 9, 22, '04. Died 9, 28, '04. Physician, Stanton. Male. White. Foreign-born (Newfoundland). Married. Age, twenty-eight years. Occupation, not recorded. Two children died of meningitis. Probable source of contagion, mother and wife's mother. Previous diseases, measles and influenza. Duration of illness, two and one-half years. Principal symptoms, cough, hemoptysis, pain, expectoration, dyspnea, hoarseness, night-sweats. Weight, condition of heart, liver, spleen, and kidneys not recorded. Sputum, positive for tubercle bacilli. Urine, 1020, acid, no albumin, no sugar, a few hyaline and granular casts microscopically. Died of hemorrhage. Diagnosis, pulmonary tuberculosis and laryngeal tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Cavities in both lungs and emphysema; adhesive pleurisy; fatty liver; congested kidney; heart, normal; spleen, enlarged.

Liver, large; capsule upon right side is adherent to under surface of diaphragm; weight, one thousand six hundred and seventy-six grams; color, dark red, paler than normal; no visible tubercles. Microscopic appearance: Moderate congestion with compression of liver-cells and distention of the capillaries; typical miliary tubercles with giant-cells, intra-acinal in position; no increase in bile-ducts; no increase in fibrous tissue; no amyloid.

Case No. 236. Admitted 9, 1, '04. Died 10, 2, '04. Physician, Walsh. Male. White. Single. Native. Age, thirty-two. Occupation, not stated. Source of contagion, probably mother. Duration of illness, eight years. Principal symptoms, cough, expectoration, constipation, hemoptysis, pain in abdomen. Highest weight, one hundred and forty pounds; lowest, one hundred and twenty-five pounds; weight on admission, one hundred and twenty-four pounds. Heart, dulness smaller than normal; pulmonic second markedly accentuated. Liver, not enlarged. Spleen, enlarged. Kidney, not recorded. Urine shows trace of albumin. Sputum, positive for tubercle bacilli. Diagnosis, pulmonary tuberculosis, tuberculous cystitis, tuberculosis of kidney.

Pathological diagnosis, R. C. Rosenberger: Fibroid tuberculosis of right lung; tuberculosis of left lung with cavity formation; pleurisy of both; chronic parenchymatous nephritis of right kidney; ulcerative tuberculosis of left; cystitis; amyloid spleen; congestion and calcified tubercle of liver; heart, normal.

Liver, about normal; weight, one thousand eight hundred and twenty-nine grams; consistence, firm; color, normal; no amyloid; shows calcified tubercle ½ cm. in diameter. Microscopic appearance: Moderate congestion; typical miliary tubercles, periportal in position; slight amyloid; no increase in fibrous tissue; no newly formed bile-ducts.

Case No. 2662. Admitted 8, 8, '04. Died 10, 7, '04. Physician, Landis. Female. White. Married. Age, forty. Occupation, tattooed woman in a circus for eight years; last twenty years, housework. Markedly alcoholic at one time. Probably infected from her father. Has had scarlatina and diphtheria as a child. Denied syphilis. Sick, six months. Symptoms, cough, expectoration, dyspnea on exertion, epigastric pain after eating, bowels constipated, slight edema. Highest weight, one hundred and sixty-five pounds; lowest, one hundred and twenty-two pounds; weight on admission, one hundred and four pounds. Liver, spleen, and thyroid not enlarged at first examination. Tubercle bacilli present. Urine, 1022, trace of albumin, no sugar, no casts. Heart, not recorded. On 8, 25, '04 it is noted that patient gives a history of excess in alcohol over a long

period, and that liver is enlarged and edge is hard, but smooth, and is not tender; on 9, 16, '04 patient complains of marked epigastric pain, more marked after taking food; on 9, 24, '04 patient is markedly jaundiced; liver is slightly enlarged; pressure in epigastric region causes a great deal of pain; no mass is found; no bile in the urine. On 9, 26, '04 blood examined: 3,840,000 red blood-corpuscles, 10,000 white blood-corpuscles; blood pale and coagulated with difficulty; jaundice very marked; conjunctiva a bright yellow; liver is distinctly palpable; edge is sharp and feels hard; enlargement apparent in left lobe. On 10, 5, '04 urine gave a distinct reaction for bile; jaundice is intense; there is a trace of albumin, but no casts; extreme tenderness in epigastric region. On 10, 7, '04, day of death: jaundice still extreme; pain in epigastrium intense; pulse weak and irregular; stools resemble putty; for past two or three days has had five to eight movements daily. In view of intense jaundice there was diagnosed some obstruction within or without the common duct, and, as no tumor could be felt in the pancreatic region, it was thought the trouble was in the duct.

Pathological diagnosis, R. C. Rosenberger: Left lung shows small cavities and tuberculous pneumonia; right lung shows few caseous nodules; heart shows fatty infiltration of muscle; spleen is large and shows small yellowish-white nodules scattered through it; kidneys are fatty and contain tubercles; miliary tuberculosis of spleen and liver.

Liver, enlarged; weight, two thousand and sixteen grams; dense and granular on surface; edges are rounded; its color is pale; scattered throughout are numerous small yellowish-white areas of firm consistence—some few are coalesced; the bile-duct is patulous; the gall-bladder is distended with fluid, glycerin-like in consistence. Microscopic appearance: Many caseous areas, containing no giant-cells and surrounded by epithelioid and small round-cells—apparently the so-called solitary tubercle of the liver; there are also typical miliary tubercles containing giant-cells; the caseous nodules correspond to the yellowish-white nodules seen macroscopically, and they contain tubercle bacilli in their periphery; there is an increase in the amount of fibrous tissue; there is apparently no amyloid; no congestion.

Case No. 2701. Admitted 9, 12, '04. Died 10, 9, '04. Physician, Hatfield. Male. Black. Native. Single. Age, twenty-two. Occupation, waiter and huckster. Exposure to contagion from a friend. Measles in childhood. Had been sick one year. Symptoms, cough, expectoration, dyspnea, gastric disturbances, diarrhea, night-sweats. Highest weight, one hundred and forty-five pounds; lowest weight, one hundred and twelve pounds; weight on admission, one hundred and seventeen pounds. Liver, markedly tender. Spleen, thyroid, and kidney apparently normal. Heart, slightly increased to right and to left. Sputum, positive for tubercle bacilli. Urine, albumin a trace, otherwise negative. Diagnosis, tuberculosis of lungs, larynx, intestines.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of lung with cavity formation; tuberculous pneumonia; pleurisy; parenchymatous nephritis; mitral endocarditis; tuberculous appendicitis and peritonitis.

Liver, normal size; weight, one thousand three hundred and two grams; firmer and darker than normal; gall-bladder contains 20 c.c. clear fluid, light yellow in color. Microscopic appearance: Moderate grade of congestion; no typical miliary tubercles with giant-cells found; few collections of round and epithelioid cells with caseation found; no amyloid; no increase in fibrous tissue and no newly formed bile-ducts; tubercle bacilli not found.

PATHOLOGICAL SECTION

Case No. 2446. Admitted 7, 13, '04. Died 10, 16, '04. Physician, McCarthy. Female. Black. Native. Single. Age, seventeen years. Occupation, housework. Source of contagion, not ilicited. Previous diseases, influenza, measles, pertussis. Duration of illness, two years. Principal symptoms, cough, expectoration, dyspnea on exertion, hoarseness, chills, and night-sweats. Highest weight, one hundred and ten pounds; ordinary weight, one hundred and six pounds; lowest weight, ninety-eight pounds; on admission, eighty-two pounds. Liver, normal in size, tender to touch. Spleen, thyroid, and kidney apparently normal. Heart, dulness normal; pulmonary second accentuated. Sputum, positive for tubercle bacilli. Urine, 1030, trace of albumin; microscopically, hyaline and granular casts. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, Joseph Walsh: Cavities in both lungs and caseous pneumonia in left base; pleurisy of both sides; fatty infiltration of liver; enlarged mesenteric glands; probably ulcers of the appendix. Heart, normal.

Liver, normal size; weight, one thousand two hundred and nine grams; consistence, firm; color, paler than normal; contains several pale areas, evidently of a fatty nature; gall-bladder small, contains a small quantity of dark, fluid bile. Microscopic appearance: Moderate grade of congestion; a few typical miliary tubercles containing giant-cells; no increase of fibrous tissue; no newly formed bile-ducts; no tubercle bacilli, and no amyloid.

Case No. 2602. Admitted 7, 12, '04. Died 11, 1, '04. Physician, Norris. Female. White. Single. Native. Age, twenty-eight. Occupation, housework. Source of contagion, mother. Previous diseases, measles, pertussis, scarlatina. Has been ill for one year. Principal symptoms, cough, expectoration, pain in abdomen, dyspnea, hoarseness, anorexia, constipation, chills, sweats, and edema. Highest weight, one hundred and five pounds, one year before admission; ordinary weight, one hundred pounds; lowest weight, eighty-three pounds; weight on admission, eighty-three pounds. Liver, spleen, thyroid, and kidney are not enlarged. Heart is slightly enlarged to left, shows a hemic systolic murmur at base; tubercle bacilli in sputum. Urine, turbid, 1020, acid. no albumin, no sugar. Some tenderness in epigastrium and diarrhea two months before death. On 8, 18, '04 liver was slightly enlarged. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Ulcerative tuberculosis of both lungs; emphysema and bronchiectasis, with miliary tuberculosis of right lung; amyloid spleen; tuberculous enteritis; parenchymatous nephritis; congestion of liver; atheroma of aorta; heart slightly enlarged.

Liver, normal size; dark in color; weight, one thousand three hundred and thirty-three grams; firm consistence; few small areas in left lobe which are either coagulative necrosis or fatty infiltration; gall-bladder distended and contains dark, tarry fluid. Microscopic appearance: Mild grade of congestion; one typical miliary tubercle with giant-cell near branch of portal vein, yet not in the portal spaces; no amyloid; no increase in fibrous tissue; no newly formed bile-ducts.

Case No. 2180. Admitted 3, 31, '04. Readmitted 7, 16, '04. Died 10, 27, '04. Physician, Landis. Female. White. German. Married. Age, forty-two. Nine children and two miscarriages. Occupation, housework. Probable source of contagion, mother. Previous disease, rheumatism, sixteen years before. Principal symptoms, cough, expectoration, pain in chest, hoarseness, vomiting, chills, and night-sweats. Lowest weight before admission, one hundred and two pounds; weight on admission, one hundred pounds. Heart, dulness normal; a

systolic murmur at the apex; pulmonary second accentuated and a systolic murmur at pulmonary cartilage. Liver, increased midway to umbilicus and very tender. Spleen and kidney, apparently normal. Sputum, positive for tubercle bacilli. Urine, amber, acid, 1024, albumin a trace, no sugar, no casts or pus-cells, diazo positive. Diagnosis, pulmonary tuberculosis; mitral regurgitation.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of lungs with cavities in both lungs; caseous pneumonia in right lung; pleurisy of both sides; congestion of liver; mitral valvulitis; parenchymatous nephritis; atheroma of aorta and splenic artery; capsulitis of spleen and liver; appendicitis; pericarditis.

Liver slightly enlarged; normal color and consistence; weight, one thousand nine hundred and twenty-six grams; veins sharply dilated; more or less mottled on section; gall-bladder extends below margin of liver and contains yellowish, tenacious bile. Microscopic appearance: Moderate congestion; one typical miliary tubercle, periportal in position; marked amount of fatty change found on periphery of the lobules; no amyloid; no increase of fibrous tissue; no newly formed bile-ducts.

Case No. 2494. Admitted 6, 10, '04. Died 11, 1, '04. Physician, Hatfield. Male. White. Single. Irish. Age, twenty-three. Occupation, hospital porter. Moderate drinker. No source of contagion elicited. Previous diseases, typhoid (?) six months before; rheumatism (?) four months before; measles; influenza (?) three years before. Has been sick three years. Symptoms, cough, expectoration, dyspnea on exertion, diarrhea, occasional chills, night-sweats, edema of the feet. Highest weight, one hundred and twenty-two and one-half pounds; ordinary weight, one hundred and twenty pounds; lowest weight, one hundred and five pounds; weight on admission, one hundred and one-half pounds. Liver and spleen apparently normal. Heart, dulness increased to right and left; second sounds accentuated; no murmurs. Sputum, positive for tubercle bacilli. Urine, alkaline, 1022, no sugar, trace of albumin, slight diazo. Diagnosis, tuberculosis of intestines, lungs, and surgical kidney.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs; cavities and miliary tubercles; adherent pleurisy; tuberculosis of intestines and appendix, of right kidney, ureter, and bladder; cloudy swelling of right kidney; enlarged mesenteric and bronchial glands; small cyst of prepuce.

Liver, enlarged, pale, firm; weight, one thousand seven hundred and five grams; edges rounded; gall-bladder distended, extending below margin of ribs; upon section, organ is pale and mottled. Microscopic appearance: Marked grade of fatty change found at periphery of the lobules; atypical miliary tubercles without giant-cells; newly formed bile-ducts; no increase in fibrous tissue; slight amount of congestion.

Case No. 2815. Admitted 10, 18, '04. Died 11, 9, '04. Physician, McCarthy. Female. White. Native. Married. Age, twenty-eight. Has had two children. Occupation, housework. Source of infection, mother. Previous diseases, malaria, four years ago, pneumonia as a baby, measles in childhood. Duration of illness, nine months. Principal symptoms, cough, expectoration, dyspnea on exertion, diarrhea, amenorrhea. Highest weight, one hundred pounds; ordinary weight, one hundred pounds; lowest weight, ninety-five pounds; weight on admission, not recorded. Heart, normal in size; both pulmonic and aortic second accentuated. Liver, not enlarged. Spleen, not enlarged. Thyroid, enlarged on the right side. Kidney, not palpable. Sputum, positive for tubercle bacilli. Urine, not examined. Diagnosis, pulmonary tuberculosis.

PATHOLOGICAL SECTION

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs with cavity formation; coalesced tubercles in both lungs; caseous pneumonia and emphysema of right lung; adhesive pleurisy; red atrophy of liver; dilatation of right side of heart; displacement of uterus to right; enlarged mesenteric and bronchial glands.

Liver, enlarged; extending 3 cm. above the umbilicus; is darker than normal; weight, two thousand one hundred and eight grams; distention of veins; on inferior surface of right lobe there are small pale areas which extend in the liver substance a short distance, but are mostly superficial. Gall-bladder is distended. Microscopic appearance: Marked grade of congestion with distention of capillaries and compression of liver-cells; typical miliary tubercles, intra-acinal in position; no amyloid; no newly formed bile-ducts; no increase of fibrous tissue.

Case No. 2596. Admitted 7, 11, '04. Died 11, 8, '04. Physician, McCarthy. Male. White. Divorced. Native. Age, forty-two. Occupation, weaver for twelve years; driver. Moderate drinker. Source of infection, possibly step-father. Previous diseases, typhoid fourteen years ago; rheumatism three years ago; measles and pertussis in childhood. Has been ill two years. Principal symptoms, cough, expectoration, dyspnea on exertion, hoarseness, chills, night-sweats, edema. Highest weight, one hundred and eighty pounds; ordinary weight, one hundred and sixty-eight pounds; lowest weight, one hundred and fifty pounds; weight on admission, one hundred and twenty-four and one-half pounds. Liver, normal in size; has a sharp edge. Spleen, thyroid, and kidney are normal. Heart is normal. Sputum, positive for tubercle bacilli. Urine, 1010, alkaline, no albumin, no sugar, diazo positive. Diagnosis, pulmonary tuberculosis; neuritis.

Pathological diagnosis, R. C. Rosenberger: Adhesive pleurisy on both sides; emphysema with miliary tubercles in left lung; cavity formation and caseous pneumonia of right lung; congestion of kidney; congestion of liver with apparently calcified tubercles; enlarged mesenteric and bronchial glands; cystitis; atheroma of tibial and femoral arteries; heart, apparently normal; larynx shows ulcers.

Liver, normal in size; weight, one thousand four hundred and eighty-eight grams; firm and dark; shows congestion and dilatation of blood-vessels; on right lobe are several yellowish, firm nodules, which are calcareous. Microscopic appearance: Marked grade of fatty change on the periphery of the lobules; moderate amount of congestion; atypical miliary tubercles, both intra-acinal and periportal; no increase in fibrous tissue; no newly formed bile-ducts; no amyloid.

Case No. 2787. Admitted 10, 11, '04. Died 11, 17, '04. Physician, Landis. Female. White. Married. Native. Age, thirty-five. Had four children. Occupation, dressmaker and housework. Source of contagion, brother. Previous diseases, measles and pertussis in childhood. Duration of illness, two years. Principal symptoms, cough, pain in chest, expectoration, dyspnea on exertion, chills, night-sweats, and edema of ankles. Highest weight, one hundred and twenty-four pounds; ordinary weight, one hundred and twelve pounds; weight on admission, not recorded. Heart, apparently normal; pulmonary second accentuated. Liver, enlarged two finger-breadths below costal margin. Spleen and kidneys, not enlarged. Thyroid, enlarged. Sputum, positive for tubercle

bacilli. Urine, yellow, acid, no albumin, no sugar, diazo positive. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of lungs with cavity formation in both apices; miliary tubercles and emphysema; congestion of liver and kidneys; enlarged thyroid; enlarged mesenteric glands; enlarged bronchial glands; edema of brain; cysts of ovaries; ulcers in caput coli.

Liver, slightly enlarged, dark red; normal; weight, one thousand four hundred and eighty-eight grams; is displaced downward; gall-bladder projects below margin. Microscopic appearance: Moderate congestion; one atypical tubercle lacking the giant-cell; it is intra-acinal in position; no fatty change; no newly formed bile-ducts; no increase in fibrous tissue; no amyloid.

Case No. 2899. Admitted 11, 15, '04. Died 11, 22, '04. Physician, Walsh. Male. White. Married. Polander. Age, twenty-six. Occupation, laborer in a morocco factory. Source of contagion, not elicited. No history of previous diseases. Has been ill five years. Principal symptoms, cough, hemoptysis, expectoration, pain in side, dyspnea on exertion, hoarseness, chills, night-sweats, edema of feet. Highest weight, one hundred and seventy-five pounds; ordinary weight, one hundred and sixty pounds; lowest recent weight, one hundred and twenty-five pounds; weight on admission, not obtained. Liver dulness lessened by tympany of abdomen and emphysema of lungs. Spleen and thyroid, normal. Kidney, not palpable. Heart, apparently normal. Sputum, positive for tubercle bacilli. Urine, 1024, no albumin, no sugar, hyaline casts, and a few pus-cells. Diagnosis, tuberculosis of lungs; acute tuberculous pneumonia.

Pathological diagnosis, R. C. Rosenberger: Ulcerative and miliary tuberculosis of both lungs; gangrene of right lung; edema and emphysema of both lungs; miliary tubercles in liver; tubercles in kidney; appendicitis; enlarged mesenteric and bronchial glands pleurisy; tuberculosis of right adrenal; heart, middle aortic cusp shows fenestration.

Liver, enlarged, two thousand two hundred and eight grams; dark; firm; veins prominent; the whole substance shows numerous small whitish areas—some scattered, others coalesced. Microscopic appearance: Marked congestion and compression of liver-cells; miliary tubercles (atypical) containing small round and epithelioid cells and caseation, but no giant-cells; there is apparently some increase of fibrous tissue, the fibrous tissue extending from about the portal veins in between the hepatic cells; this shows well with the van Giesen stain; no tubercle bacilli; no amyloid.

Case No. 2796. Admitted 10, 13, '04. Died 11, 25, '04. Physician, Hatfield. Male. White. Single. Native. Age, eighteen. Occupation, clerk. No source of contagion elicited. Previous diseases, measles and scarlet fever in childhood. Duration of illness, one year. Principal symptoms, cough, expectoration, dyspnea on exertion, hoarseness, and diarrhea. Highest weight, one hundred and twenty-eight pounds; lowest weight, one hundred and seventeen pounds; weight on admission, one hundred and six and one-quarter pounds. Heart, dulness normal in size; both aortic and pulmonic second markedly accentuated. Liver, not enlarged. Splenic dulness slightly increased. Thyroid and kidneys, normal. Sputum, positive for tubercle bacilli. Urine, 1022, no albumin, no sugar, diazo positive. Diagnosis, miliary tuberculosis of the lung; tuberculous peritonitis and enteritis.

PATHOLOGICAL SECTION

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs with cavity formation; edema; congestion and caseous pneumonia; pleurisy; valvulitis of mitral and aortic valves; fatty liver; fatty kidneys with congestion; enlarged mesenteric and bronchial glands; tuberculous ulcers of ileum.

Liver, normal in size; weight, one thousand eight hundred and twenty grams; edges rounded; pale and firm; no visible tubercles. Microscopic appearance: Typical miliary tubercles containing giant-cells; the tubercles are periportal in position; there are many newly formed bile-ducts; around one branch of the portal vein are many newly formed bile-ducts and a collection of small round-cells and epithelioid cells without a giant-cell; no increase in fibrous tissue; no tubercle bacilli found; no amyloid; slight congestion.

Case No. 2821. Admitted 10, 20, '04. Died 11, 27, '04. Physician, McCarthy. Male. White. Swedish. Single. Age, thirty-four. Occupation, waiter. Source of contagion, not elicited. Previous disease, measles. Duration of illness, five months. Principal symptoms, cough, expectoration, dyspnea, night-sweats. Highest weight, one hundred and seventy-five pounds; ordinary weight, one hundred and seventy-five pounds; lowest recent weight, one hundred and fifty-five pounds; weight on admission, one hundred and thirty-six pounds. Liver, enlarged midway to umbilicus, but not tender. Spleen, enlarged, palpable on deep inspiration. Thyroid and kidneys, normal. Heart, normal apparently. Sputum, positive for tubercle bacilli. Urine. 1024, no albumin, no sugar, diazo positive. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Ulcerative tuberculosis of left lung with scattered miliary tubercles; miliary tuberculosis; emphysema; atelectasis of right lung; pleurisy with effusion; appendiceal ulcer; congestion of kidneys; fatty (?) liver; enlarged bronchial glands; heart dilated, especially on right side.

Liver, enlarged, two thousand one hundred and sixty-six grams, and on section presents a few small nodules, presumably tubercles; consistence firm; no amyloid reaction; gall-bladder distended and contains brown, tenacious bile; no calculi. Microscopic appearance: Marked grade of congestion with atrophy of some of the liver-cells and hypertrophy of others; one large tubercle is found in a periportal position; it consists of epithelioid and small round-cells and caseous material; one giant-cell is found; no increase of fibrous tissue; no newly formed bile-ducts.

Case No. 2716. Admitted 9, 7, '04. Died 11, 30, '04. Physician, McCarthy. Female. White. Widow. Foreign. German. Age, thirty-eight. Had one child. Occupation, ran a steam press. Not alcoholic. Source of contagion, probably brother. Previous diseases, typhoid, smallpox, and measles. Duration of illness, six months. Principal symptoms, cough, expectoration, dyspnea on exertion, constipation, and night-sweats. Highest weight, one hundred and forty-six pounds; lowest recent weight, ninety-eight pounds; weight on admission, ninety-two and one-half pounds. Heart, normal except for accentuation of both pulmonic and aortic second. Liver is enlarged. Spleen, not demonstrably enlarged. Thyroid, slightly enlarged. Right kidney prolapsed. Sputum, positive for tubercle bacilli. Urine, 1020, trace of albumin, granular casts, diazo positive. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs with cavity formation; emphysema of left lung; empyema; fatty liver; parenchy-

matous nephritis; appendiceal ulcer; pleurisy; enlarged thyroid; accessory spleen; enlarged mesenteric and bronchial glands.

Liver, enlarged; weight, one thousand eight hundred and sixty grams; pale and rather firm; apparently fatty; no amyloid reaction. Microscopic appearance: Moderate congestion with atrophy of some cells and hypertrophy of others; no tubercles found; no increase of fibrous tissue; no newly formed bile-ducts; no amyloid.

Case No. 551. Admitted 4, 27, '04. Died 11, 20, '04. Physician, Ravenel. Female. White. Single. German. Age, nineteen. Occupation, house-servant. Source of contagion, not elicited. Previous disease, typhoid fever in 1902. Principal symptoms, cough, expectoration, hemoptysis, dyspnea on exertion. Highest weight, ninety-eight pounds; lowest recent weight, ninety-eight pounds; on admission, one hundred and twelve and one-half pounds. Heart, dulness normal; no murmurs. Liver and spleen, not enlarged. Sputum, positive for tubercle bacilli. Urine, negative Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Tuberculosis of both lungs with cavity formation; emphysema; edema; chronic pneumonia; a few miliary tubercles; nephritis; peritonitis; congestion of intestines; red atrophy of liver; enlarged bronchial glands.

Liver, comparatively large; weight, one thousand six hundred and seventy-four grams; color, dark; consistence, normal; upon section shows changes of red atrophy; gall-bladder contains large quantity of tenacious bile. Microscopic appearance: Marked congestion—so marked that the liver-cells in the neighborhood of the hepatic vein are almost totally destroyed; on the periphery of the lobule the cells are in a better state of preservation; no tubercles found; no increase of fibrous tissue; no newly formed bile-ducts; no amyloid.

Case No. 2856. Admitted 11, 2, '04. Died 11, 30, '04. Physician, Ravenel. Female. White. Widow. Irish. Age, forty-eight. Had seven children. Occupation, housework. No source of contagion elicited. Pervious diseases, pleurisy, rheumatism, pertussis. Has been ill three years. Principal symptoms, cough, expectoration, dyspnea on exertion, anorexia, diarrhea, chills. Highest weight, not known; ordinary weight, one hundred and seventeen pounds; lowest recent weight, not known; on admission, weight, seventy pounds. Liver, not palpable. Spleen, thyroid, and kidneys are not palpable. Heart, normal apparently. Sputum, positive for tubercle bacilli. Urine, 1012, no sugar, no albumin, no diazo. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, R. C. Rosenberger: Ulcerative tuberculosis of both lungs; tuberculous pneumonia of both organs; emphysema; edema; tuberculosis of left adrenal; tuberculous peritonitis and enteritis; enlarged mesenteric and bronchial glands; adhesive pleurisy. Heart shows thickening and atheroma of mitral and aortic leaflets; heart is very small; weight, one hundred and fifty grams. Spleen shows amyloid reaction.

Liver apparently normal; normal in color; firm consistence; weight, one thousand seven hundred and sixty-three grams; gall-bladder is distended and contains thin, pale, viscid bile. Microscopic appearance: Moderate congestion; many typical miliary tubercles containing giant-cells, periportal, intra-acinal, and near hepatic vein; no increase in fibrous tissue; no tubercle bacilli found; no newly formed bile-ducts; no amyloid.

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Case No. 2926. Admitted 11, 26, '04. Died 12, 22, '04. Physician, Ravenel. Female. White. Single. Native. Age, nineteen. Occupation, shop-girl. Source of contagion, a friend. Previous diseases, malaria and measles. Duration of illness, three years. Principal symptoms, cough, hemoptysis, expectoration, dyspnea on exertion, diarrhea, night-sweats, amenorrhea. Highest weight, one hundred and ten pounds three years before; ordinary weight, not known; lowest weight, seventy-six pounds three months before; weight on admission, not recorded. Heart, apparently normal. Liver, spleen, thyroid, and kidneys, all normal. Urine, albumin positive, sugar negative, diazo slight; microscopically, pus. Symptom, positive for tubercle bacilli. Diagnosis, pulmonary tuberculosis.

Pathological diagnosis, Joseph Walsh: Tuberculosis of both lungs with cavity formation; tuberculosis of bronchial and mesenteric glands and appendix; dilated right and left ventricle; parenchymatous nephritis.

Liver, normal size, dark, no other abnormalities. Microscopic appearance: Marked congestion; cells markedly atrophic; so-called red atrophy; no tubercles found; no amyloid; no increase of fibrous tissue; no newly formed bile-ducts.

Case No. 2855. Admitted 11, 1, '04. Died 12, 26, '04. Physician, Hatfield. Male. White. Native. Married. Age, twenty-nine. Occupation, plumber. Alcoholic. Source of contagion, a friend. Previous diseases, measles and diphtheria. Duration of illness, two years. Principal symptoms, cough, pain in throat, expectoration, dyspnea on exertion. Highest weight, one hundred and forty-four pounds four months before; ordinary weight, one hundred and forty pounds; lowest weight, one hundred and twenty-one pounds two weeks before; weight on admission, one hundred and thirteen and one-half pounds. Liver, not enlarged. Spleen, kidney, and thyroid, normal. Heart, apparently normal; aortic accentuated. Sputum, positive for tubercle bacilli. Urine, acid, 1026, no albumin, no sugar, diazo positive. Diagnosis, tuberculosis of lungs, pharynx, and larynx.

Pathological diagnosis, C. Y. White: Tuberculosis of lungs with right-sided pneumothorax; bilateral pleurisy with effusion; miliary tubercle in kidney and diffuse nephritis; the right lung contains cavities; the left, a few scattered miliary tubercles; heart is slightly enlarged and right side is dilated.

Liver is about normal in size; color is yellowish with the markings of the capillaries distinct; the consistence is firm; the liver projects 6 cm. in the mid-sternal line. Microscopic appearance: Moderate congestion with pronounced atrophy of the liver-cells; one atypical miliary tubercle, intro-acinal in position; contains small round-cells, epithelioid cells, and caseation, but no giant-cells; no tubercle bacilli; no fibrous tissue; no newly formed bile-ducts.

Case No. 3010. Admitted 12, 22, '04. Died 1, 9, '05. Physician, Stanton. Male. White. Single. Native. Age, thirty-seven. Occupation, stevedore. Markedly alcoholic. Source of contagion, not elicited. Previous diseases, syphilis, twenty years before. Duration of illness, two years. Principal symptoms, cough, expectoration, marked dyspnea, hoarseness, diarrhea, edema of feet. Highest weight, two hundred and ten pounds five years before; ordinary weight, one hundred and eighty to one hundred and eighty-five pounds; lowest weight, one hundred and forty pounds six months before. Heart, enlarged; both second sounds accentuated. Liver, palpable, edge sharp and painless. Spleen, enlarged in proportion. Thyroid, apparently normal. Kidney, not palpable. Sputum, positive for tubercle bacilli. Urine, 1020, neutral, no sugar,

trace of albumin, diazo positive; no casts. Diagnosis, pulmonary tuberculosis; arteriosclerosis; cirrhosis of the liver, hallucinations.

Pathological diagnosis, C. Y. White: Chronic tuberculous arthritis of hip-joint; chronic and acute tuberculosis of lungs; cavity small in right lung; acute miliary tuberculosis of kidney; fatty cirrhosis and acute miliary tuberculosis of liver; chronic obliterating pleurisy and pericarditis; ischiorectal abscess and ulceration of rectum; chronic tuberculous adenitis of pelvic and abdominal glands; tuberculosis of adrenals; tuberculosis of bladder and prostate.

Liver, 25 by 17 by 9½ cm.; weight, two thousand two hundred and nineteen grams; color, mottled yellowish to brown and studded with yellowish-white tubercles; consistence, much softer than normal; surface, granular; throughout the organ there are numerous small miliary tubercles. Microscopic appearance: Numerous miliary tubercles both with and without giant-cells; the tubercles are periportal and intra-acinal in position; there are numerous tubercle bacilli found; there is an increase of fibrous tissue, the fibrous tissue radiating from about the portal vein between the liver-cells; no amyloid; slight congestion; no newly formed bile-ducts.

DISCUSSION ON DR. ULLOM'S PAPER

Dr. Alfred Meyer, New York: I should like to ask Dr. Ullom if in the diagnosis of these cases of tuberculosis of the liver, auscultation of the liver had been practiced to see if there were any perihepatic signs.

Dr. H. R. M. Landis, Philadelphia: During the past year I have been interested in trying to make a clinical diagnosis of tuberculosis of the liver and only recently have I abandoned such an attempt deeming it impossible. The suggestion that Dr. Meyer offers might aid us. In all cases of enlarged liver in tuberculosis that organ is tender. The only reliable symptom is jaundice, and yet this symptom is so rare in tuberculosis that it practically offers no aid whatever. In one case I had under observation there was a tuberculosis of the large conglomerate type and the jaundice was so intense as to suggest a blockage of the common duct, either from a growth in the pancreas or in the duct itself. At autopsy there were no evidences of any obstruction.

Dr. Josephus Ullom, Philadelphia: My experience coincides with that of Dr. Landis, that one cannot make a diagnosis of tuberculosis of the liver except in rare instances.

THE KIDNEYS IN TUBERCULOSIS

A Pathological and Clinical Study of One Hundred Kidneys from Cases of Tuberculosis of the Lungs Compared with Twenty-six Kidneys from Cases of Non-tuberculosis

Joseph Walsh, M.D.

Philadelphia

In the second annual report of the Henry Phipps Institute I have made a report on the kidneys in fifty-nine cases of advanced tuberculosis of the lungs which came to autopsy at the Henry Phipps Institute and in one private case in which the lung condition was practically cured.

The present study adds to the report thirty-eight cases of advanced tuberculosis of the lungs and three cases of non-tuberculosis from the Henry Phipps Institute, two cases of advanced tuberculosis of the lungs and twenty-two cases of non-tuberculosis from the Philadelphia Hospital and one case of non-tuberculosis from the Pennsylvania Hospital; altogether, therefore, the present report is on one hundred cases of tuberculosis of the lungs and twenty-six cases in which no tuberculosis was discovered.

The kidneys were cut into very small pieces and every abnormality studied, first macroscopically, then stained and studied microscopically. The two kidneys were usually cut into about one hundred and sixty small pieces. A varying number (from three to one hundred and twenty) of microscopic specimens were studied from each pair of kidneys. In addition all of the second series of kidneys (sixty-six) were cut in various directious in order to discover if this would make any difference in the findings. I may say at once that the difference in direction of the section made no difference whatsoever in the findings, so that whether the specimen is taken parallel to the central cut through the kidney or perpendicular makes no difference.

Many specimens in the previous study were imbedded only in celloidin, many others in both celloidin and paraffin. The paraffin specimen, however, proved so much superior for the study of minute details that celloidin was dropped as an imbedding medium and in this second series all specimens were imebedded only in paraffin. The specimens were hardened in Müller-Formol and stained with hemotoxylon and eosin. Fifty-six of those from tuberculous cases, and all from the non-tuberculous cases were also stained with Van Giesen's. Fifty-eight were stained with Gentian violet. The remainder will be stained by Gentian violet later. Five of the tuberculous and two of the non-tuberculous were also stained by carbol-fuchsin and gabbets.

The various forms of nephritis found in the kidneys in the hundred cases of tuberculosis of the lungs were:

Acute parenchymatous nephritis	36
Chronic parenchymatous nephritis	33
Diffuse nephritis	4
Interstitial nephritis	14
Amyloid degeneration	5
Cloudy swelling	7
Passive congestion	1

In the twenty-six cases of non-tuberculosis the kidneys showed chronic interstitial nephritis fifteen times, chronic parenchymatous four times, acute parenchymatous four times, amyloid degeneration once, cloudy swelling once and normal once. The last two were from infants less than one month old.

The sex, age and pathological diagnosis in the cases of non-tuberculosis were as follows:

In the fifteen cases showing interstitial nephritis:

Male, age 33, lobar pneumonia, atrophic cirrhosis of liver, splenomegaly, chronic catarrhal colitis.

Male, age 37, hypostasis and edema, chronic adhesive pleurisy, cyanotic induration of spleen, follicular enteritis, hepatic congestion, cyanotic kidney, purulent meningitis.

Male, age 40, hypertrophy and dilatation of heart, chronic adherent pleurisy, congestion of lungs, infarcts of kidney, beginning cirrhosis of liver.

Male, age 45, aneurism of ascending portion of arch of aorta, chronic interstitial nephritis, chronic endocarditis, chronic pleurisy, fibroid pneumonia, edema of lungs, congestion of lungs, arterio-sclerosis, parenchymatous degeneration of myocardium.

Male, age 46, aneurism of arch of aorta, cylindrical dilatation of the ascending aorta, dilated left heart, bilateral hydrothorax, passive congestion of liver, spleen and kidneys.

Male, age 49, rupture of aorta, chronic interstitial nephritis, acute nutmeg liver, congestion of spleen, atheroma of arteries.

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Male, age 50, hemo-pericardium with puncture of anterior wall of right ventricle, hypertrophy of heart, hemi-hydrothorax, pleuritis, atelectasis of left lung, hypostatic congestion of lungs, nephritis (chronic interstitial), fatty atheromatous arteries, cirrhosis of liver, catarrhal colitis, acute gastritis, general anasarca, phimosis with gangrene of penis.

Male, age 51, hypertrophy and dilatation of heart, fatty degeneration of heart, chronic endocarditis, atheroma of aorta especially about coronary arteries, chronic interstitial nephritis, red atrophy of liver.

Male, age 63, hypertrophy and dilatation of heart, mitral stenosis and regurgitation, chronic passive congestion of liver, chronic interstitial nephritis (secondary), congestion and edema of lungs.

Male, age 67, brown atrophy of heart, emphysema, edema of lungs, fibrosis of spleen, fatty and cystic degeneration of kidneys, cystitis, chronic hypertrophy of prostate, double hydrocele, fatty cirrhosis of liver, cholelithiasis.

Male, age 68, hypertrophy of left ventricle, general arterio-sclerosis, bilateral chronic pleuritis, congestion and edema of lungs, chronic interstitial nephritis, cholelithiasis, Meckel's diverticulum.

Male, age 48, paretic dementia.

Female, age 37, hypertrophy and dilatation of heart, double pleural effusion, chronic pleuritis, edema and congestion of lungs, perisplenitis, fatty cirrhosis of liver, peri-hepatitis, ascites, fibrinous peritonitis, catarrhal endometritis, fibrosis of ovaries.

Female, age 50, fatty infiltration of heart, arterio-sclerosis, congestion and edema of lungs, circumscribed gangrene of left lung, chronic interstitial nephritis, congestion of liver, cholelithiasis, fibro-myoma of uterus.

Female, age 61, pneumonia, croupous of right and left lower lobes, emphysema and edema of lungs, mitral and aortic stenosis, atheroma of coronary arteries, parenchymatous nephritis, nutmeg liver.

In the four cases showing chronic parenchymatous nephritis:

Male, age 20, typhoid fever with its ordinary associated phenomena, congested lungs.

Male, age 53, hypertrophy of heart, acute fibrinous bronchitis, area of softening following occipital lobe of the left hemisphere, also of left lateral area of cerebellum.

Female, age 37, fatty myocarditis, patulous foramen ovale, parenchymatous nephritis, cloudy swelling and early fatty changes in liver, strangulated epiploica appendix, chronic inflammation of stomach.

Female, age 67, broncho-pneumonia, some cirrhotic changes in liver, diffuse nephritis.

In the four cases showing acute parenchymatous nephritis:

Male, age 14, chronic vegetations on mitral valve with calcification, aortic leaflets greatly thickened, several small infarcts in right and left kidneys.

Male, age 17, typhoid fever, lobar pneumonia, cloudy swelling of kidneys, acute splenic tumor.

Male, age 25, hypertrophy and dilatation of heart, edema of lungs, hemorrhagic infarction of right lung, hypostatic pneumonia, nephritis, anasarca, passive congestion of liver and spleen.

Female, age 69, pleuritic adhesions, chronic endocarditis, aortic sclerosis, parenchymatous nephritis, fibroma of uterus, chronic salpingitis.

In one case of amyloid degeneration:

Male, age 54, encephaloid cancer of stomach with secondary growth in liver, brown atrophy of heart, arterio-sclerosis, amyloid degeneration of liver and kidneys.

In one case of cloudy swelling:

Male, age 1 month, anemia general; catarrhal enteritis.

In one case of normal kidney:

Female, age 8 days, ileo colitis.

A specimen was described as acute parenchymatous nephritis when it showed distinct cloudy swelling and more or less degeneration and necrosis of the epithelium without further change; as diffuse nephritis when there were degeneration and necrosis of the epithelium and considerable interstitial infiltration with round cells; chronic parenchymatous nephritis when there were degeneration and necrosis of the epithelium with some thickening of the interstitial tissue; as interstitial nephritis when the thickening of the interstitial tissue predominated the degenerative changes in the epithelium.

In the study of the last forty kidneys from cases of tuberculosis a further division was made of parenchymatous nephritis into degenerative and desquamative. Of these forty twelve showed acute degenerative, one acute desquamative, thirteen chronic degenerative and two chronic desquamative. The remainder of the forty were of course divided among the other forms of nephritis.

The common forms of nephritis in my category, therefore, are acute and chronic parenchymatous. It is very possible, in fact probable, that the acute parenchymatous nephritis and the cloudy swelling were caused by the terminal infection and bore no relation to the tuberculosis; omitting these and the one kidney showing only passive congestion, we have fifty-six kidneys (out of one hundred from cases of tuberculosis) showing a chronic condition that might have been influenced by the tuberculosis. To my mind this is not a large number when we consider the length of time the ordinary cases of tuberculosis last and the multiple mixed infections that the majority of them pass through or remain afflicted with for months and sometimes even for years.

Of these fifty-six thirty-three showed chronic parenchymatous nephritis, and fourteen chronic interstitial nephritis. It is these two, therefore, that especially attract our attention as the typical kidneys of tuberculosis.

From my own studies I have come to consider the chronic parenchymatous nephritis, or to define it still further the chronic degenerative nephritis, as the typical nephritis of tuberculosis. It occurs in about thirty per cent. of cases. This chronic degenerative nephritis is not a marked condition, in fact, in the majority of cases it might be defined as a chronic degenerative nephritis of moderate grade.

The chronic interstitial nephritis found usually appears as if it had begun as a focal interstitial nephritis, as if it were the result of an accumulation of localized fibrous areas forming so closely together that we eventually have a general interstitial condition. This form of nephritis will be discussed later in connection with fibrous areas.

It is worth while mentioning that I have never yet come across a case of hemorrhagic or glomerulo-nephritis in connection with tuberculosis.

In the hundred cases positive tubercles were found fifty-five times; by positive here is meant that the tubercle contained both caseation and giant cells. This number, fifty-five out of one hundred, is, therefore, a small estimate of the actual number of tubercles, since it will readily be granted that many tubercles, especially young ones, show neither caseation or giant cells. These tubercles were found in the cortex thirty-six times; in both cortex and pyramids fourteen times; and in the pyramids alone five times.

Tubercles were found in association with all the different forms of nephritis in such numbers that the tubercles could be considered to have little or no influence on the nephritis and reversely, the nephritis little or no influence on the development of the tubercles. Of the thirty-six cases of acute parenchymatous nephritis twenty showed tubercles; of the thirty-three cases of chronic parenchymatous nephritis eighteen showed tubercles; of the four cases of diffuse nephritis three showed tubercles; of the fourteen cases of interstitial nephritis eight showed tubercles; of the five cases of amyloid degeneration four showed tubercles; and of the seven cases of cloudy swelling two showed tubercles.

Apart from tubercles the most common and most interesting abnormalities were localized fibrous areas showing marked thickening of the interstitial tissue (found sixty-nine times in one hundred cases). These localized fibrous areas were usually situated under the kidney investment, and extended in wedge shape towards the pyramids, varying in length (one to three or four mm.) and breadth (one to two mm.),

and comprehending a smaller or larger number of tubules. In these the interstitial tissue was markedly thickened, the tubules were usually dilated, and the epithelium atrophic. The tubules frequently contained hyaline casts even when no hyaline casts were present elsewhere. The glomeruli were often shrunken and fibroid; Bowman's capsule was almost always thickened. A round-cell infiltration sometimes took the place of the connective tissue. In other words, these localized fibrous areas are focal areas of interstitial nephritis.

Macroscopically, these fibrous areas are seen as whitish or yellowish specks on the surface of the kidneys or immediately under or near the investment on section. They quite resemble tubercles in their appearances, and were more than once mounted and stained under this impression. Microscopically they look like healed or healing tubercles, though they never show giant cells and only occasionally what appears like a small amount of caseation.

It is possible that the question might be raised that these fibrous areas are small healed infarcts, but it must be remembered that although they occur most frequently immediately under the investment they are also found scattered through the cortex.

After my first study of the kidneys in tuberculosis I thought it was possible to attribute these fibrous areas to the tubercle bacillus. They represent undoubtedly healed inflammatory foci and with the tubercle bacillus to account for them, I saw no reason to look further. In my own mind I had framed this pathogenesis: the general chronic degenerative nephritis is probably due to the tuberculous toxin or to the toxin of the mixed infection and the focal interstitial nephritis which sometimes eventuates in widespread interstitial nephritis is due to the bacillus itself. My conclusion was based on the argument that although we are ready to attribute a general sclerosis of organs, even of the lungs, to an indefinite cause, like for instance an unknown toxin circulating in the blood, we usually insist especially in the lungs that a localized sclerosis must have been produced by a local cause, for instance, an acute abscess, an actinomycosis, a tuberculosis, a gumma or a foreign body. I was further persuaded into the idea by the fact that we often find fibrous areas absolutely typical in appearance and discover in other specimens that they are connected with and are definitely part of a tubercle. In other words, the edge of a tubercle showing a tendency to heal exactly resembles a fibrous area, why may

the typical fibrous areas not be tubercles in which the healing process keeps in advance of caseation or giant cell formation?

Recent study, however, especially of the kidneys from non-tuberculous cases, has caused me to recede somewhat from this first position. The reason is evident. Out of the twenty-four adult cases of non-tuberculosis I found localized fibrous areas resembling those seen in tuberculous cases twelve times; in other words, in fifty per cent. of cases of non-tuberculosis in comparison with sixty-nine per cent. of cases from tuberculosis.

On first thought it might seem that the question as to whether or not these localized fibrous areas were produced by the tubercle bacillus could be easily settled by staining them for tubercle bacilli. Second thought, however, shows the fallacy of this, for even though they were caused by tubercle bacilli, at the stage when they are recognizable as fibrous areas the process is practically a healed one and the tubercle bacilli would have disappeared. Moreover in my own experience of staining the kidneys of tuberculous cases for tubercle bacilli, when they were found they were evident in every part of the kidney, I mean within the convoluted tubules, in the epithelium of the convoluted tubules, in the glomeruli, in the interstitial tissue and in fibrous areas. Other investigators say the same, among whom may be mentioned Coffin,[1] D'Arrigo,[2] Futterer[3] and Hauser.[4] In one case of non-tuberculosis with fibrous areas in the kidneys I stained three specimens for tubercle bacilli, and in another five specimens. I found no tubercle bacilli however.

Another common abnormality (thirty-six out of one hundred cases) was an accumulation of round cells immediately under the investment. These accumulations varied in size from 0.5 to 1 or even 2 mm. in diameter. They probably represent either young tubercles or beginning localized fibrous areas.

The following table shows the frequency of tubercles, localized fibrous areas and accumulations of round cells in relation to one another in cases of tuberculosis. So far scarcely more than a mere statistical study of these abnormalities has been made. As can be seen the various forms of nephritis are associated and not associated with these abnormalities in such numbers that no conclusions are evident, at least at first view, from their relationship:

[1] Coffin. These de Paris, 1890.
[2] D'Arrigo. Centralbl. fur Bakt., vol. 28, Sept. 1900, p. 225.
[3] Futterer. Virch. Archiv, No. 100, 1885, page 236.
[4] Hauser. Deutsches Archiv fur Klinische Medicin, 40, 1887.

- Acute parenchymatous nephritis, 36
  - with tubercles, 20
    - with fibrous areas, 13
      - with round cell accumulation, 4
      - without round cell accumulation, 9
    - without fibrous areas, 7
      - with round cell accumulation, 2
      - without round cell accumulation, 5
  - without tubercles, 16
    - with fibrous areas, 9
      - with round cell accumulation, 6
      - without round cell accumulation, 3
    - without fibrous areas, 7
      - with round cell accumulation, 1
      - without round cell accumulation, 6
- Chronic parenchymatous nephritis, 33
  - with tubercles, 18
    - with fibrous areas, 16
      - with round cell accumulation, 7
      - without round cell accumulation, 9
    - without fibrous areas, 2
      - with round cell accumulation, 1
      - without round cell accumulation, 1
  - without tubercles, 15
    - with fibrous areas, 8
      - with round cell accumulation, 2
      - without round cell accumulation, 6
    - without fibrous areas, 7
      - with round cell accumulation, 0
      - without round cell accumulation, 7
- Diffuse nephritis, 4
  - with tubercles, 3
    - with fibrous areas, 3
      - with round cell accumulation, 2
      - without round cell accumulation, 1
    - without fibrous areas, 0
      - with round cell accumulation, 0
      - without round cell accumulation, 0
  - without tubercles, 1
    - with fibrous areas, 1
      - with round cell accumulation, 0
      - without round cell accumulation, 1
    - without fibrous areas, 0
      - with round cell accumulation, 0
      - without round cell accumulation, 0
- Interstitial nephritis, 14
  - with tubercles, 8
    - with fibrous areas, 7
      - with round cell accumulation, 3
      - without round cell accumulation, 4
    - without fibrous areas, 1
      - with round cell accumulation, 0
      - without round cell accumulation, 1
  - without tubercles, 6
    - with fibrous areas, 6
      - with round cell accumulation, 6
      - without round cell accumulation, 0
    - without fibrous areas, 0
      - with round cell accumulation, 0
      - without round cell accumulation, 0

- Amyloid degeneration, 5
  - with tubercles, 3
    - with fibrous areas, 2
      - with round cell accumulation, 0
      - without round cell accumulation, 2
    - without fibrous areas, 1
      - with round cell accumulation, 0
      - without round cell accumulation, 1
  - without tubercles, 2
    - with fibrous areas, 0
      - with round cell accumulation, 0
      - without round cell accumulation, 0
    - without fibrous areas, 2
      - with round cell accumulation, 0
      - without round cell accumulation, 2
- Cloudy swelling, 7
  - with tubercles, 2
    - with fibrous areas, 1
      - with round cell accumulation, 0
      - without round cell accumulation, 1
    - without fibrous areas, 1
      - with round cell accumulation, 0
      - without round cell accumulation, 1
  - without tubercles, 5
    - with fibrous areas, 3
      - with round cell accumulation, 0
      - without round cell accumulation, 3
    - without fibrous areas, 2
      - with round cell accumulation, 1
      - without round cell accumulation, 1
- Passive congestion
  - without tubercles, 1
    - No fibrous areas or cellular accumulations

The following table shows the relation in a small way (on account of the small number of cases) of fibrous areas and cellular accumulations to different forms of nephritis in cases of non-tuberculosis:

Interstitial nephritis	with fibrous areas, 8	with cellular accumulations, 5 without cellular accumulations, 3
	without fibrous areas, 7	with cellular accumulations, 2 without cellular accumulations, 5
Chronic parenchymatous nephritis	with fibrous areas, 1	with cellular accumulations, 1 without cellular accumulations, 0
	without fibrous areas, 3	with cellular accumulations, 0 without cellular accumulations, 3
Acute parenchymatous nephritis	with fibrous areas, 2	with cellular accumulations, 1 without cellular accumulations, 1
	without fibrous areas, 2	with cellular accumulations, 0 without cellular accumulations, 2
Amyloid degeneration	with fibrous areas, 1	without cellular accumulations, 1

In forty cases (of the one hundred tuberculous cases) in which we have records of whether or not the capsule strips easily or with difficulty we find the following:

		Tubercles.	Capsule Strips	
			Easily.	With Difficulty.
Acute parenchymatous nephritis	with	5	3	2
	without	8	6	2
Chronic parenchymatous nephritis	with	8	3	5
	without	7	5	2
Interstitial nephritis	with	5	2	3
	without	4	2	2
Cloudy swelling	with	1	0	1
	without	1	1	0
Amyloid degeneration	with	1	1	0
	without	0	0	0

		Tubercles or Fibrous Areas.	Capsule Strips	
			Easily.	With Difficulty.
Acute parenchymatous nephritis	with	10	6	4
	without	3	3	0
Chronic parenchymatous nephritis	with	13	6	7
	without	2	1	1
Interstitial nephritis	with	9	4	5
	without	0	0	0
Cloudy swelling	with	2	1	1
	without	0	0	0
Amyloid degeneration	with	1	1	0
	without	0	0	0
Total recorded cases		40	22	18

PATHOLOGICAL SECTION

A pretty complete macroscopic study of the kidneys was made, though comparatively little can be gotten from it. The weight of the organs differs so widely on account of the difference in weight and size of individuals that it means very little. The average weight of the kidneys in the different forms of nephritis in individuals over twenty years of age was as follows: Acute parenchymatous nephritis, 6½ ounces; chronic parenchymatous nephritis, 6⅛ ounces; diffuse nephritis, 6⅓ ounces; interstitial nephritis, 9½ ounces; amyloid degeneration, 6½ ounces; and cloudy swelling, 6¼ ounces.

Two things can be deduced from these tables, namely, whether the capsule strips easily or with difficulty gives no indication of the kidney condition or of the presence or absence of tubercles or fibrous areas.

Other macroscopic abnormalities were as follows:

		Tubercles or Fibrous Areas.	Surface.		Consistency.		Cortex.		
			Smooth.	Granular.	Firm.	Decreased.	Increased.	Decreased.	Normal.
Acute parenchymatous nephritis.	with.....	10	7	3	8	2	7	2	1
	without.	3	2	1	2	1	1	1	1
Chronic parenchymatous nephritis	with.....	13	9	4	11	2	7	3	3
	without.	2	1	1	1	1	2	0	0
Interstitial nephritis.....	with.....	9	4	5	5	4	5	4	0
	without.	0	0	0	0	0	0	0	0
Cloudy swelling.....	with.....	2	1	1	2	0	0	2	0
	without.	0	0	0	0	0	0	0	0
Amyloid degeneration.....	with.....	1	1	0	1	0	0	1	0
	without.	0	0	0	0	0	0	0	0
Total recorded cases.....		40	26	15	30	10	22	13	5

This table shows that the kind of nephritis or the presence or the absence of tubercles or fibrous areas is in no way indicated by the surface being either smooth or granular, the consistency firm or decreased, the cortex increased, decreased or normal.

The macroscopic diagnosis of the kidney condition made at autopsy from the general appearance frequently differed from the microscopic diagnosis. In the seven cases of cloudy swelling the macroscopic diagnosis was twice parenchymatous nephritis, twice fatty kidneys, once toxic nephritis, once diffuse nephritis and once cloudy swelling. In the thirty-six cases of acute parenchymatous nephritis the macroscopic diagnosis was five times toxic nephritis, twelve times parenchymatous nephritis, five times congestion, six times diffuse nephritis, once fatty

kidneys, once interstitial nephritis, once nephritis, and five times negative. In the thirty-three cases of chronic parenchymatous nephritis the macroscopic diagnosis was nine times toxic nephritis, seven times parenchymatous nephritis, four times fatty kidneys, four times diffuse nephritis, twice cloudy swelling, once glomerulo-nephritis, twice interstitial nephritis, twice congestion, and twice negative. In the fourteen cases of interstitial nephritis the macroscopic diagnosis was once fatty kidney, five times toxic nephritis, once interstitial nephritis, once parenchymatous nephritis, once diffuse nephritis, once miliary tuberculosis, and four times negative. In the four cases of diffuse nephritis the macroscopic diagnosis was twice parenchymatous nephritis, once miliary tuberculosis, and once negative. In the five cases of amyloid degeneration the macroscopic diagnosis was once fatty kidney, once miliary tuberculosis, once glomerulo-nephritis, and twice amyloid.

Microscopically every part of the kidney structure whether normal or abnormal was commented on, namely, the kidney investment; the distance of the Malpighian bodies from the kidney investment; the condition of the convoluted tubules between the kidney investment and the first row of Malpighian bodies; the condition of the glomerulus, of Bowman's capsule; the condition of the convoluted tubules throughout the cortex, of the interstitial tissue between them, of the tubules of the medullary rays, and, in a general way, of the pyramids.

Microscopically the kidney investment was usually normal, rarely, no matter what the kidney condition, thickened and only once thinner than normal. The following table shows the frequency in the different cases:

		Tubercles or Fibrous Areas.	Investment.		
			Normal.	Thickened.	Thinner.
Acute parenchymatous nephritis..	with.....	29	28	1	0
	without	7	7	0	0
Chronic parenchymatous nephritis	with.....	28	25	3	0
	without	5	5	0	0
Diffuse nephritis	with.....	4	4	0	0
	without	0	0	0	0
Interstitial nephritis	with.....	14	9	4	1
	without	0	0	0	0
Cloudy swelling.....	with.....	5	4	1	0
	without	2	1	1	0
Amyloid degeneration.....	with.....	4	4	1	0
	without	1	1	0	0
Passive congestion.....	with.....	0	0	0	0
	without	1	1	0	0

PATHOLOGICAL SECTION

In cases of non-tuberculosis the investment was as follows:

	Normal.	Thicker.	Thinner.
Interstitial nephritis	9	5	1
Chronic parenchymatous nephritis	2	1	1
Acute parenchymatous nephritis	4	0	0
Amyloid degeneration	1	0	0
Cloudy swelling	1	0	0
Normal	1	0	0

The principal things mentioned about the Malpighian bodies in each case were whether or not the glomerular tufts were congested, vacuolated or fibroid; how much space there was between the glomerulus and Bowman's capsule; and whether or not Bowman's capsule showed the epithelium proliferated or the connective tissue increased.

The glomeruli were usually congested (eighty-five times out of ninety-two recorded cases). The glomeruli were frequently congested without congestion appearing in other parts of the kidneys, as can be seen from the fact that the cortex (not considering the glomerulus) was congested forty-nine times and the pyramids seventy-two times.

In the twenty-six non-tuberculous cases the glomeruli were congested twenty-three times, the cortex fifteen times, and the pyramids eighteen times.

By vacuolated is meant small vacuoles looking like fat droplets in the midst of the loops, probably in the endothelium—at least Le Noir (quoted by Guihal) describes them as fat droplets in the endothelium. Such vacuolization was very frequent (sixty-four times out of ninety-four recorded cases). None of the abnormalities in the glomerulus were more common to one kind of nephritis than to another, and none were influenced by the presence or absence of tubercles.

Some observers have found the glomerular cavity dilated, others found no free space. In this series, out of eighty-three recorded cases there was no space between the glomerulus and Bowman's capsule in sixteen cases, one line space (or practically normal) in fifty-six cases, two lines space or what might be called dilatation in eleven cases. In other words, the space was usually normal in all forms of nephritis. The cases of non-tuberculosis correspond with the cases of tuberculosis.

The connective tissue of Bowman's capsule was found thickened seventy-nine times out of the hundred cases. This constitutes the most frequent abnormality found. Sometimes this thickening was very

slight and required confirmation by Van Giesen's stain to prove it. The same thickening of Bowman's capsule was evident in the non-tuberculous cases.

There was slight proliferation of the epithelium of Bowman's capsule in eight cases. One observer has found in tuberculosis a true glomerulitis which I have failed to find.

The convoluted tubules commonly showed degeneration and necrosis of the epithelium, more or less extensive and widespread. Under the investment the convoluted tubules were frequently dilated and the epithelium atrophic. In advanced cases of parenchymatous nephritis the epithelium, even when atrophic, was disintegrated, frequently filling the lumen with debris. Close to the pyramids also the convoluted tubules were often somewhat dilated. Between these two extreme boundaries of the cortex the convoluted tubules usually showed a lumen normal in size, or smaller than normal, due to swelling of the epithelium and the epithelium itself depending on the form of nephritis was swollen, granular, degenerated, necrotic or desquamated. The statistics of the condition of the convoluted tubules is evident from the microscopic diagnosis.

The tubules of the medullary rays, especially the spiral tubule, showed usually the same changes as the middle layer of the convoluted tubules. Moreover these changes were often found continued into the upper part of the pyramids in the ascending limb of Henle and the collecting tubules.

The interstitial tissue was thickened in forty-seven cases (namely, in the cases of chronic parenchymatous, diffuse and interstitial nephritis). This thickening was, in the majority of cases, not marked, and sometimes required confirmation by van Giesen's stain in order to prove it. The only fourteen cases in which it was distinctly marked were those of interstitial nephritis.

Out of the hundred tuberculous cases the blood-vessels were thickened in eight out of fourteen of the cases of interstitial nephritis, in seven out of thirty-six cases of acute parenchymatous nephritis, in seven out of thirty-three cases of chronic parenchymatous nephritis, in four out of four cases of diffuse nephritis, and in four out of five of amyloid degeneration. Out of the twenty-six non-tuberculous cases the blood-vessels were thickened in ten out of the fifteen cases of interstitial nephritis, in the one case of amyloid degeneration and in one case of acute parenchymatous nephritis. This thickening was usually limited

to the intima, except in the amyloid cases, where it was evident in the media.

Hyaline casts were found in almost every case. Sometimes they were only few in number and sometimes did not occur outside of tubercles or fibrous areas, but they were almost constantly present. Hyaline casts were also found in the majority of cases of non-tuberculosis and in all forms of nephritis and even in the normal kidney from the child one week old.

Other abnormalities: In the tuberculous cases cysts were found in six cases of acute parenchymatous nephritis, twelve cases of chronic parenchymatous nephritis, two cases of diffuse nephritis, seven cases of interstitial nephritis and two cases of amyloid degeneration. They were usually small, varying in size from a pin-head to a split pea. In two cases one was found as large as a walnut. In the non-tuberculous cases cysts were found in nine cases of interstitial nephritis, three cases of chronic parenchymatous nephritis, two cases of acute parenchymatous nephritis and in the one case of amyloid degeneration.

Infarcts were found among the tuberculous cases in one case of acute parenchymatous nephritis, one case of interstitial nephritis and in one case of passive congestion. Among the non-tuberculosis cases, in one case of acute parenchymatous nephritis and one case of chronic parenchymatous nephritis.

In the hundred kidneys from tuberculous cases no tumors of any kind were met with; in the twenty-six kidneys from non-tuberculous cases one metastatic carcinoma nodule was found in a case of carcinoma of the stomach, and two small hypernephromata in two other cases.

Clinical symptoms of nephritis in tuberculosis: Three years ago Flick and Walsh[1] made a preliminary report of a study of the urine in sixty cases of tuberculosis, and reported the clinical symptoms of nephritis in tuberculosis to be pain or severe ache in the lumbar region, the presence in the urine of hyaline and granular casts, pus, or white blood-corpuscles, rarely albumin, and frequently tubercle bacilli, provided tubercle bacilli were carefully searched for.

Of sixty cases of clinical tuberculosis taken more or less at random (many being early cases), they found tubercle bacilli forty-four times. Out of the forty-four cases that showed tubercle bacilli in the urine twenty-nine complained of more or less severe pain in the lumbar region

[1] Flick and Walsh. Proceedings of the Pathological Society of Philadelphia, vol. 5. Nov. 1901

over varying periods of time. They were suffering from this pain when the urine was collected. Out of the thirty-six cases in which the urinary sediment was examined thirty showed casts or white blood corpuscles. Of these thirty only two showed albumin.

In a paper on "The Vicarious Action of the Bowels for the Kidneys in Tuberculosis," read at the meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 19, 1905, Flick and Walsh presented another possible symptom of nephritis, namely, diarrhea. This report gave eleven cases of diarrhea without ulceration of the bowels or other apparent cause except the nephritis

Out of the ninety-nine recorded cases in this series the bowels were loose thirty-nine times; out of these thirty-nine cases twenty-one showed intestinal ulceration. The bowels were constipated seventeen times, and of these eight showed ulceration. The bowels were regular forty-three times, and of these twenty-one showed ulceration.

Ulceration of the bowels and diarrhea occurred in connection with the different forms of nephritis as follows:

	Tubercles.	Ulcers with Diarrhea.	Ulcers without Diarrhea.	Diarrhea without Ulcers.
Cloudy swelling	with	1	1	0
	without	3	0	2
Acute parenchymatous nephritis	with	7	6	3
	without	2	7	2
Chronic parenchymatous nephritis	with	3	8	2
	without	3	5	2
Diffuse nephritis	with	0	0	1
	without	0	0	1
Interstitial nephritis	with	2	2	4
	without	1	1	0
Amyloid degeneration	with	0	3	0
	without	0	0	1

In cases of non-tuberculosis the bowels were loose, constipated and regular, as follows:

	Loose.	Constipated.	Regular.
Interstitial nephritis	2	7	6
Chronic parenchymatous nephritis	1	1	2
Acute parenchymatous nephritis	0	0	4
Amyloid degeneration		1	
Cloudy swelling	0	0	1
Normal	1	0	0

PATHOLOGICAL SECTION

Looking at it both from the tuberculous and non-tuberculous cases diarrhea would not seem to be a symptom of nephritis. From a study of the cases showing ulcers with and without diarrhea, and diarrhea with and without ulcers, it is evident that diarrhea is not a prominent symptom of ulceration of the bowels. In the hundred tuberculous cases fifty-four showed intestinal ulcers; of these fifty-four, twenty-one had diarrhea. Out of the forty-six cases without intestinal ulceration eighteen had diarrhea; in other words, about the same proportion.

Diarrhea is supposed to be common with amyloid degeneration; this series showed it but once.

Edema is commonly considered a symptom of either heart or kidney disease. Therefore, in the following table, cardiac disease, reckoned from the pathological findings, is shown when present. Under this term heart disease is included endocarditis, myocarditis, hypertrophy and dilatation of one or both ventricles.

	Tubercles.	Edema.		No Edema.	
		With Heart Disease.	Without Heart Disease.	With Heart Disease.	Without Heart Disease.
Cloudy swelling	with	0	1	1	0
	without	1	1	2	1
Acute parenchymatous nephritis	with	2	5	5	8
	without	4	3	3	6
Chronic parenchymatous nephritis	with	4	5	4	5
	without	0	2	4	9
Diffuse nephritis	with	0	1	2	0
	without	0	0	0	1
Interstitial nephritis	with	1	0	2	5
	without	3	1	1	1
Amyloid degeneration	with	0	1	1	1
	without	0	0	2	0
Passive congestion	with	0	0	0	0
	without	0	0	0	1

Edema is ordinarily reckoned a common symptom of nephritis, but it does not appear so in connection with my own studies. In this series it was present and absent under so many conditions that it gives no clue to the condition. In the non-tuberculous cases edema was present in four out of sixteen cases of interstitial nephritis, one out of four of chronic parenchymatous nephritis, and two out of four of acute parenchymatous nephritis.

The chemical and microscopic examination of the urine in these cases was usually made only once, and that on the patient's admission to the

hospital. The specific gravity in the seventy-four recorded cases was over and under 1,020, as follows:

	Tubercles.	Under 1020.	Over 1020.
Cloudy swelling	with	0	2
	without	0	3
Acute parenchymatous nephritis	with	2	13
	without	5	7
Chronic parenchymatous nephritis	with	6	13
	without	1	4
Diffuse nephritis	with	0	2
	without	0	0
Interstitial nephritis	with	4	2
	without	3	4
Amyloid degeneration	with	1	2
	without	0	0

Out of the hundred cases, forty-seven showed albumin—the majority, however, only a slight trace. It was found in two cases of cloudy swelling, sixteen of acute parenchymatous nephritis, fifteen of chronic parenchymatous nephritis, two of diffuse nephritis, eight of interstitial nephritis, and four of amyloid degeneration. It was found in twenty-six cases with tubercles and twenty-one cases without tubercles. Its occurrence, therefore, does not aid in determining the severity of the nephritis or the presence of tubercles. In these cases the urine was examined by Mr. Karl W. Smith, who considers the slightest response to heat and acetic acid as positive. In my personal study of the urine in tuberculous cases three years ago I found albumin only twice in forty-four cases which showed tubercle bacilli in the urine. My tests were heat and nitric acid and potassium ferrocyanid and acetic acid.

In the non-tuberculous cases albumin was found in the urine in eight cases of interstitial nephritis, two cases of chronic parenchymatous nephritis and two cases of acute parenchymatous nephritis. The urine was not determined in the amyloid case.

Guihal[1] quotes Gauche as finding albumin in the urine of nine out of forty-six tuberculous cases; Lacombe, six out of one hundred; Le Noir, two hundred and eighteen out of seven hundred and fifteen; Andiganne, fifty out of one hundred. Guihal himself says that the albumin may be temporary or intermittent, that it is more common in the evening than in the morning urine, and that it is more frequent in young adults and less frequent between the ages of thirty and forty. In this series

[1] Guihal (E.). Gaz. des hop., 1902, Nos. 7–10.

of tuberculous cases the ages of the patients showing albumin in the urine were: cloudy swelling, 16, 22; acute parenchymatous nephritis, 6, 17, 19, 26, 28, 28, 28, 28, 32, 35, 37, 38, 38, 42, 46, 55; chronic parenchymatous nephritis, 17, 24, 25, 26, 28, 31, 32, 33, 33, 33, 35, 38, 40, 45, 53; diffuse nephritis, 32, 47; interstitial nephritis, 27, 33, 38, 38, 43, 49, 53, 57; amyloid degeneration, 17, 32, 35, 40. No connection of albumin could be made out between the ages and tubercles in the kidneys.

Out of the hundred cases eighteen showed casts. This small number of casts may be accounted for by carelessness in the examination of the urine. The urine was examined by many different individuals and with varying degrees of care. The examination for casts in the preliminary study by Flick and Walsh[1] was never made on less than six ounces of urine centrifugated in a water-motor centrifuge. Out of the thirty-six cases examined, casts were found twenty-four times.

The urine of a certain number of these hundred cases was examined for tubercle bacilli. In addition, under the direction of Dr. Ravenel and myself, Mr. Smith made an inoculation study of twenty-one urines. He inoculated each time the carefully washed sediment of about two thousand centimeters of urine. Altogether fifty-four guinea-pigs were used. Out of the twenty-one cases four sets of guinea-pigs died of septicemia in three or four days. Out of the remaining seventeen tubercles were found in the guinea-pigs after six weeks fourteen times (82½ per cent.).

The following table shows the details of this inoculation study in the ten patients who have since then died in the hospital. One out of the ten urines showed tubercle bacilli to staining and tubercles in the kidneys, but caused septicemia every time injected. One of the urines showed no tubercle bacilli on staining, did not produce tuberculosis in the guinea-pig, and the kidneys of the patient showed no tubercles. Out of the remaining eight urines all showed tubercle bacilli to microscopical examination, seven urines produced tuberculosis in the guinea-pig, and five kidneys showed tubercles on post-mortem study. One urine showed tubercle bacilli on staining, and the kidneys of the patient showed tubercles without the urine having any effect on guinea-pigs. Three urines showed tubercle bacilli on staining, and the guinea-pigs injected showed tuberculosis without tubercles being found in the kidneys of the patients.

In other words, it would seem that the kidneys may contain tubercles,

Case No.	Age.	Male or Female.	M. S. W.	White or Black.	Entered Hospital.	Died.	Duration of Illness.	Edema.	Sputum Tubercle Bacilli.	Urine.	Tubercle Bacilli in Urine.	No. of Pigs.	Sediment of Urine Injected.	Pigs Died Septicemia.	Tuberculosis in Pigs.	Diagnosis of the Kidney Condition in the Patient.
2676	40	M.	M.	W.	2/1/05	4/27/05	2 yrs.	No.	+	Acid, yellow, 1028, A +, D +.	+	2	900 cc.	—	—	Amyloid degeneration. Tubercles. Fibrous area. No cellular accumulations.
73	38	F.	M.	W.	2/1/05	2/20/05	23 yrs.	No.	+	Acid, 1014, A +, D +.	+	2	1200 cc.	—	+	Chronic interstitial nephritis. Tubercles. Fibrous areas. No cellular accumulations.
2481	38	M.	M.	W.	2/1/05	3/6/05	15 yrs.	No.	+	A + 1010, no casts, D +.	+	2	2000 cc.	—	+	Chronic interstitial nephritis. Tubercles. Fibrous areas. No cellular accumulations.
2989	47	M.	S.	W.	12/16/04	1/30/05	20 yrs.	No.	+	A +, D +, 1026, few granular casts, epithelial casts, debris.	+	2	1200 cc.	—	+	Diffuse nephritis. Tubercles. Fibrous areas. Round cell accumulations.
3388	36	M.	M.	W.	5/29/05	6/4/05	6 mos.	No.	+	Acid, 1020, A +, D +, a few finely granular casts.	+	2	2700 cc.	—	+	Acute parenchymatous nephritis. No tubercles. Fibrous areas. Round cell accumulations.
2977	28	F.	M.	W.	3/4/05	6/25/05	1 mo.	Marked of both feet.	+	Acid, 1026, no sugar, D +, no albumin, hyaline and waxy casts.	+	2	3000 cc.	+ One	+ One	Chronic parenchymatous nephritis. No tubercles. Fibrous areas. Round cell accumulations.
3440	26	M.	S.	W.	6/14/05	8/11/05	16 mos.	No.	+	Acid, 1022, A +, D +, few granular and waxy casts.	—	3	5000 cc.	+ One	—	Chronic parenchymatous nephritis. No tubercles. No fibrous areas. No cellular accumulations.
3697	37	F.	S.	W.	12/26/05	1/10/06	10 mos.	No.	+	Acid, 1020, D +, no albumin.	+	4	6000 cc.	+ 3	+ One	Chronic parenchymatous nephritis Tubercles. Fibrous areas. No cellular accumulations.
3355	28	F.	S	W.	5/18/05	8/4/05	3 yrs.	No.	+	Acid, 1016, A +, D +, no casts, no sugar.	+	2	1400 cc.	+ One	+ One	Acute parenchymatous nephritis. No tubercles No fibrous areas. No cellular accumulations.
3432	20	F.	S.	W.	6/12/05	8/19/05	3 yrs.	No.	+	Acid, 1020, casts, no albumin.	+	4	2000 cc.	+ 4	—	Cloudy swelling. Tubercles. Fibrous areas. No cellular accumulations.

yet the bacilli excreted in the urine be incapable of infecting guinea-pigs, and again that living tubercle bacilli capable of infecting guinea-pigs may pass through the kidneys without the kidneys showing tubercles. It is to be remembered that these kidneys were cut into pieces one-tenth to one-twentieth of an inch in diameter, and every abnormality, no matter how slight, mounted and stained. The tubercle bacilli found in the urine in these cases were found after centrifugating 2,000 c.c. urine, and sometimes not then on the first examination, but only on the second or even third examination.

The different forms of nephritis in the tuberculous cases were found in males and females according to age, as follows:

Males.	Tubercles.	Ages.
Cloudy swelling	with	23.
	without	16, 18, 22, 28.
Acute parenchymatous nephritis	with	6, 19, 20, 25, 25, 28, 28, 34, 34, 36, 37, 38, 42, 46, 46, 48.
	without	14, 18, 28, 33, 55.
Chronic parenchymatous nephritis	with	18, 24, 26, 27, 27, 29, 35, 39, 47, 52.
	without	17, 26, 26, 28, 31, 33, 33, 33, 36, 45, 64.
Diffuse nephritis	with	27, 47.
	without	32.
Interstitial nephritis	with	24, 27, 28, 35, 44, 53, 57.
	without	22, 29, 33, 43, 49, 53.
Amyloid degeneration	with	17, 40.
	without	
Passive congestion	with	
	without	21.
Females.		
Cloudy swelling	with	20.
	without	33.
Acute parenchymatous nephritis	with	28, 28, 32, 42.
	without	14, 17, 19, 19, 26, 28, 28, 28, 35, 35, 38.
Chronic parenchymatous nephritis	with	18, 22, 33, 35, 35, 37, 38, 40.
	without	25, 26, 32, 37.
Diffuse nephritis	with	31.
	without	
Interstitial nephritis	with	38.
	without	
Amyloid degeneration	with	27, 32.
	without	35.

The only thing apparent from this table of age and sex in the different forms of nephritis is the infrequency of interstitial nephritis in the female in comparison with the male. Interstitial nephritis was

found in thirteen males out of sixty-six and in only one female out of thirty-four.

In the non-tuberculous cases the number is too small for the age and sex to mean anything. A table, however, has been made for comparison:

Males

Interstitial nephritis, 33, 37, 40, 45, 46, 48, 49, 50, 51, 63, 67, 68.
Acute parenchymatous nephritis, 14, 17.
Chronic parenchymatous nephritis, 20, 53.
Amyloid degeneration, 54.
Cloudy swelling, 1 month.

Females

Interstitial nephritis, 37, 50, 61.
Acute parenchymatous nephritis, 25, 69.
Chronic parenchymatous nephritis, 37, 67.
Normal kidney, 1 week.

The heart condition both clinically and pathologically is said to correspond with certain forms of nephritis. Guihal reports that Torkiomian, a pupil of Potain's, found in renal tuberculosis the arterial tension diminished, the pulse rapid and weak, and a mesosystolic murmur at the apex. The only symptoms that I find recorded clinically in these hundred cases are murmurs, the accentuation of the second sounds at the aortic and pulmonary valves, arteriosclerosis, and the pulse rate. Murmurs were found but ten times, as follows: Systolic murmur at apex in one case of acute parenchymatous nephritis with tubercles and one case of acute parenchymatous nephritis without tubercles; at pulmonic area in one case of acute parenchymatous nephritis with tubercles and two cases of acute parenchymatous nephritis without tubercles; two cases of chronic parenchymatous nephritis with tubercles. Presystolic mitral murmur in one case of acute parenchymatous nephritis with tubercles, one case of interstitial nephritis without tubercles. Slight systolic murmur at aortic cartilage in one case of interstitial nephritis with tubercles.

Arterio-sclerosis was found in one case of acute parenchymatous nephritis with tubercles, six cases of acute parenchymatous nephritis without tubercles, three cases of chronic parenchymatous nephritis with tubercles, two cases of chronic parenchymatous nephritis without tubercles, four cases of interstitial nephritis with tubercles, one case of cloudy swelling with tubercles and one case of amyloid degeneration with tubercles.

The second sounds were accentuated as follows:

In Tuberculous Cases.	Tubercles.	No. of Cases.	Second Pulmonic Accentuated.	Second Aortic Accentuated.	Both Accentuated.	Not Accentuated.	Unrecorded.
Cloudy swelling	with	2	0	0	1	1	0
	without	5	0	1	2	2	
Acute parenchymatous nephritis	with	20	4	2	2	10	2
	without	16	9	1	2	3	1
Chronic parenchymatous nephritis.	with	18	5	2	3	7	1
	without	15	4	1	2	8	
Diffuse nephritis	with	3	1		1		1
	without	1			1		
Interstitial nephritis	with	8	2		2		4
	without	6			3		3
Amyloid degeneration	with	4	4		3		
	without	1			1		
In non-tuberculous cases.							
Interstitial nephritis		15	4	0	0		11
Acute parenchymatous nephritis		4	0	0	0		4
Chronic parenchymatous nephritis.		4	0	0	0		4
Amyloid degeneration		1	1	0	0		

From these statistics nothing can be gathered relative to the significance of murmurs in connection with nephritis. It appears that in nephritis the second pulmonic is much more frequently accentuated than the aortic.

The pulse rate was over one hundred and twenty in the hundred tuberculous cases (patients at rest or even in bed) in four cases out of seven of cloudy swelling; nineteen cases out of thirty-six of acute parenchymatous nephritis; fourteen cases out of thirty-three of chronic parenchymatous nephritis; one case out of four of diffuse nephritis; three cases out of fourteen of interstitial nephritis; two cases out of five of amyloid degeneration; and in the one case of passive congestion.

The pulse rate was over one hundred and twenty (in the twenty-six non-tuberculous cases) in five cases out of fifteen of interstitial nephritis.

The heart pathologically showed nothing that could add to the study. It was usually normal. The principal pathological conditions were dilatation of one or both ventricles. In addition it showed vegetative endocarditis once, mitral sclerosis seven times, mitral and aortic sclerosis twice and hypertrophy twice.

Following is a table of the average duration of the pulmonary tuberculosis compared with the kidney condition. This duration was not taken from the patient's statement of duration but from the physician's opinion, made after carefully weighing the history and the physical examination. In this series the diffuse and interstitial nephritis correspond to the longest duration. For the sake of completeness a table showing the average loss of weight in comparison with the kidney condition is added. This loss is the difference between the patient's highest weight and the last weight before death.

	Tubercles.	No. of Cases.	Average Duration. Years.	Average Loss of Weight. Pounds.
Cloudy swelling	with	2	3	14
	without	5	1½	25
Acute parenchymatous nephritis	with	20	3	31
	without	16	3⅓	34
Chronic parenchymatous nephritis	with	18	3	36
	without	15	3	37
Diffuse nephritis	with	3	10	35
	without	1	8	55
Interstitial nephritis	with	8	11	40
	without	6	9	51
Amyloid degeneration	with	4	1½	56
	without	1	1	59
Passive congestion	with	0	0	0
	without	1	7	63

Before coming to any conclusions in regard to the pathogenesis of the nephritis in tuberculosis, I wish to study the relations of some of these statistics more fully and see the results of certain experiments at present in progress.

Conclusions in regard to the kidneys in cases of tuberculosis of the lungs:

Pathological. 1. A comparison of one hundred kidneys from cases of tuberculosis of the lungs with twenty-six kidneys from a variety of other conditions shows apparently nothing outside of tubercles that can be said to be specific to the tuberculosis.

2. Every form of nephritis was found except hemorrhagic and glomerulo-nephritis. The most common forms were acute and chronic degenerative.

3. Positive tubercles were found in the kidneys in fifty-five per cent. of cases.

PATHOLOGICAL SECTION

4. The most common abnormalities found were fibrous and cellular areas under the investment or throughout the cortex. The former occurred in sixty-nine per cent. of the cases of tuberculosis and fifty per cent. of the cases of non-tuberculosis.

5. The macroscopic appearance of the kidneys frequently failed to correspond with the microscopic diagnosis.

Clinical. 1. Inoculation experiments showed tubercle bacilli in the urine in eighty-two and five-tenths per cent. of the urines inoculated.

2. Tubercle bacilli were found in the urine on microscopical examination in ninety per cent. of cases.

3. Sometimes the bacilli found in urine, even in cases showing tubercles in the kidneys, do not affect guinea-pigs.

4. Sometimes bacilli are found in the urine capable of infecting guinea-pigs without tubercles being found in the kidneys.

5. Edema was found in thirty-five per cent. of cases. It was most frequent in association with acute parenchymatous nephritis.

6. Albumin was found to the heat and acetic acid test in forty-seven per cent. of cases. It was found most commonly in connection with amyloid degeneration, though occurred under all pathological conditions, even cloudy swelling.

7. Casts and pus-cells apparently depend on the carefulness of the observer, varying in my studies from eighteen per cent. to sixty-six per cent.

8. The heart was commonly normal both clinically and pathologically; when abnormal, no relation was found between the heart and the kidney condition.

9. The nephritis accompanying tuberculosis may be surmised but cannot be assured; with the possible exception of amyloid, the kind of nephritis cannot be even surmised.

10. The most common clinical symptoms of nephritis in tuberculosis, according to my personal studies, are hyaline and granular casts and tubercle bacilli in the urine. Less frequent symptoms are pain or ache in the lumbar region, albumin in the urine and edema. Still other symptoms appear to be unusual fatigue upon slight exertion, unaccountable dyspnea, and rapid pulse.

DISCUSSION ON DR. WALSH'S PAPER

Dr. Lawrence F. Flick, Philadelphia: I have long looked upon the kidney complications of tuberculosis as among the most serious that can

occur and the most difficult to treat. Years ago Grancher and Martin demonstrated experimentally upon animals that the penalty paid for immunity often was nephritis. This is often true in clinical medicine. In proportion to the immunity developed by the individual is there danger of nephritis and frequently, after years of health, cases go out by way of nephritis when apparently they had only lung lesions. I have come to look upon nephritis as one of the most serious complications to be met in the treatment of tuberculosis. Unfortunately, as stated by the reader of the paper, we do not easily recognize these cases of nephritis; and yet we do get indications which should place us on guard, even though we cannot establish the diagnosis. Among these indications are two of importance, the rapid pulse and great fatigue. Personally I am inclined to think that accentuation of the second sound should also give warning. I have looked back over some of my cases to find the coincidence of rapid pulse and accentuated second sound which I could not control and wondered over to have occurred in the cases which ultimately developed acute nephritis and died. One of these cases was a particularly striking one. A young woman recovered from tuberculosis of the lungs and followed her occupation as a teacher for a few years and then had a slight recurrence of the lung lesion, which did not amount to much. Quite suddenly she developed an acute condition which was diagnosed by the physician called in as dysentery and she died inside of three days. At autopsy there was nothing the matter with the bowels but there was an acute nephritis. The lung lesions had practically healed.

Dr. E. G. Janeway, New York: I simply want to make a suggestion to the reader of the paper, that where tubercular bacilli are found in the urine without any evidence of kidney trouble, he should look further for lesions of the seminal vesicles, of the testicle, of the bladder, or some other portion of the genito-urinary passages.

Dr. Alfred Meyer, New York: I should like to ask what method could be used to eliminate a disturbing factor in the examination for the tubercle bacilli, the smegma bacillus. So far as I know our bacteriological friends have not yet an absolutely reliable means of recognizing these two organisms, the tubercle bacillus and the smegma bacillus.

Dr. Joseph Walsh, Philadelphia: Dr. Janeway's point is well taken and I shall have the seminal vesicles and the bladder looked up.

In regard to Dr. Meyer's question relative to differentiating tubercle

bacilli from smegma bacilli, I might say that this question was brought up two years ago following a clinical study of the urine in tuberculosis made by Dr. Flick and myself on sixty cases of tuberculosis. We found what looked like tubercle bacilli forty-four times out of sixty cases. These bacilli were differentiated from smegma bacilli by the ordinary methods, namely, the use of alcohol in addition to Gabbet's solution. Despite this many questioned that they were tubercle bacilli. It was on account of the uncertainty of these results that the present study of the kidneys themselves was taken up in order to discover the frequency of actual tuberculous lesions in the kidneys.

The present study showed positive tubercles, that is, tubercles with caseation and giant cells, in 55 per cent. of cases. In addition, the inoculation study of guinea-pigs injected with the urine of tuberculous patients showed a positive result in 82 per cent. of cases. We feel, therefore, that the tubercle bacilli found in the urine in forty-four out of sixty cases (73 per cent.) were probably true tubercle bacilli.

In the individual cases it is, of course, impossible to prove to a skeptic that the bacilli found in the urine by staining are true tubercle bacilli, for even when that particular urine infects guinea-pigs it might still be said that the bacilli, or at least some of them, seen on staining were smegma bacilli. In my own experience, however, I have found tubercle bacilli on staining less frequently than on inoculation (73 per cent. to 82 per cent.); moreover smegma bacilli are not numerous even in smegma, and in urine are at most rare; add to this the fact granted by all investigators that smegma bacilli are usually if not always decolorized by alcohol, and remembering that the specific microorganisms are found in the urine in practically every infectious disease I am ready to believe that the bacilli found in the urine in cases of tuberculosis which fail to decolorize with acid and alcohol are true tubercle bacilli.

The present study showed the urine containing tubercle bacilli to staining and to inoculation when no tubercles were found in the kidneys; and again tubercle bacilli to staining and failure on inoculation in cases in which tubercles were found in the kidneys. I am willing to contend, therefore, that tubercle bacilli may be excreted by the kidneys without producing lesions in them and that sometimes these bacilli are either dead or so decreased in virulence that they are not capable of infecting guinea-pigs.

THE CLINICAL AND PATHOLOGICAL COMPARISON OF CAVITIES

By H. R. M. Landis, M.D.

Philadelphia

This paper has been prepared with the view of reconciling some of the divergent views in regard to cavities in pulmonary tuberculosis particularly from the standpoint of diagnosis.

From its inception, it has been the custom at the Phipps Institute to bring before the members of the staff at its weekly meetings the results of each autopsy. Blackboard diagrams of the clinical findings are made and these are then compared with the fresh anatomical specimens.

The fifty-three cases I have analyzed died during the year 1905; the autopsies having been made by C. Y. White, pathologist to the Institute, and the clinical examination by members of the house staff, numbering eight.

The opportunity which a large number of autopsies has afforded of verifying clinical findings has shown that errors are not infrequent. Thus, a cavity is diagnosed as being present which the post-mortem fails to reveal or cavities actually present have escaped notice. The question of whether a lung contains a cavity is of considerable importance from the standpoint of prognosis. Small cavities or fairly large ones which are sharply defined, and especially if dry, make for a fairly favorable prognosis, while communicating cavities or single cavities with active constitutional symptoms render the prognosis grave.

In any case, however, the prognosis should be guarded, owing to the possibility of a sudden and fatal hemorrhage. Quite recently, I saw a man whose history indicated disease of some years standing and who had in the apex of the right lung a large, quiescent cavity. He had a slight cough and some expectoration in the morning but no other symptoms. A favorable prognosis was given but he died suddenly one week later from a large pulmonary hemorrhage. The possibility of such an accident can never be guarded against, as it is well known that once an

excavation has formed it is never obliterated. Furthermore, there is no means of knowing whether the blood vessels have become completely obliterated. Another menace to the individual with a cavity is the constant danger of mixed infection. Even under the most favorable circumstances these excavations are points of least resistance and no lung containing them is as safe from outside influences as the one in which the infected area is firmly walled off by fibrous tissue. On the other hand, it sometimes happens that the patient's condition is improved by the formation of a cavity, for with the removal of a necrosed area an immediate improvement is noted in the constitutional symptoms. Such an individual, however, must always be subjected to the dangers mentioned above.

Perhaps the most striking feature of tuberculosis of the lungs is the excavations which occur. In the chronic types, this feature is present in the majority of cases. In the acute forms of the disease, the so-called pneumonic and broncho-pneumonic types, excavations are not unusual, particularly in the broncho-pneumonic form, although the process may be so acute as to cause death before breaking down of the caseous areas occurs. This is the type of the disease usually occurring in children and in the majority of the lower animals. Even in general miliary tuberculosis excavations are not uncommon and in some instances must be looked on as the infecting source of the generalized process.

I have heard it asserted that every case of tuberculous infection of the lung develops some evidence of excavation, however small. Of seventy-eight cases which Flint analyzed from this standpoint sixty-two showed cavitation; of the sixteen without cavities five were of the acute miliary type, leaving ten of the more chronic forms in which no excavations had occurred. Of fifty-three cases examined at the Phipps Institute during 1905 fifty had well marked cavities. The longer the tuberculous process lasts, no matter how slow its progress, the more certainly is excavation apt to occur, although in very latent and chronic cases, the so-called fibrous phthisis, the disease may last for years and at death show no evidence of cavity formation. In those types where the tuberculous process, aided by mixed infection, pursues a more or less rapid course, excavations occur quickly. Cavity formation is usually a gradual process, at least so far as we are able to judge by physical signs. Occasionally, however, the excavation is

formed suddenly and in an area where consolidation had been noted for weeks the unmistakable signs of cavity will be noted.

The wall of a cavity consists of three parts: (1) a caseous lining in which all trace of lung tissue is lost, the margin of which towards the cavity are breaking down; (2) a zone in which early tuberculous changes both interstitial and alveolar are seen, and (3) an outside zone of small-celled infiltration (West). Similar changes may be going on in adjacent caseous areas with communicating fistulous tracts giving the lung a honey-combed appearance. Recently formed cavities have an irregular outline, are ill defined, the interior is ragged and there is an absence of a distinct wall. Cavities of this description are met with in acute tuberculosis and in the chronic types in those portions of the lung where the disease is advancing. When the process is less acute or has remained localized for some time the outer zone of small-celled infiltration develops into more or less well formed fibrous tissue. When this occurs the caseous lining is less as is also the area of tuberculous infiltration.

Cavities which have existed for a long time develop a thick fibrous surrounding and the caseous lining gradually changes into granulation tissue which is in turn replaced by fibrous tissue, giving the interior a smooth lining. Secretion then ceases or nearly so and the cavity is designated as dry or quiescent. Various stages of this process are met with in chronic tuberculosis.

Cavities of any considerable size contain in their walls or in the trabeculae transversing them bronchi and blood vessels. The latter, in the chronic cases, usually become thrombosed and obliterated, although even in these cases a fatal termination may be brought about by rupture of a small aneurysmal dilatation. In the destruction of tissue it is inevitable that a number of bronchi are involved. As a rule most of these bronchi are destroyed by the tuberculous process or occluded by the fibrous tissue. External communication is then brought about by the breaking down of the tuberculous process or by ulceration of the surrounding lung tissue until a larger bronchus with its thicker walls is incorporated in the diseased area. This being more resistant to the necrotic process remains patulous. It is not, however, often that a cavity is drained by more than one or two such openings. Where a number of such openings remain patent or where the opening is single and small, the physical signs are imperfect and to this fact must be ascribed the failure in some instances to recognize excavation.

PATHOLOGICAL SECTION

According to West "in the more acute cases there will be a larger amount of caseous material, more bacilli as a rule, and a greater likelihood of fragments of lung tissue in the sputum. In the more chronic cases the amount of pus is larger, and it is observed in the sputum that the amount of pus and the number of bacilli often stand in inverse proportion to each other."

To Louis we are indebted for the observation that when tuberculosis attacks the lungs it almost invariably involves the apices first. This fact was further elaborated by Kingston Fowler, who showed that it is not the extreme apex which is involved but a point an inch to an inch and a half below the apex and that after tending to spread backwards the course of the disease is downwards, the upper lobe and apex of the lower lobe on the primary side being involved before the apex of the opposite side is attacked.

As excavation is the final stage in the tuberculous process it is but natural to look for the evidence of cavity formation where the disease first appeared. In an analysis made by Ewart cavitation occurred at

The apices	282 times
Dorso-axillary region	227 times
Mammary region	189 times
Sternal region	61 times
Base	32 times

The distribution of the fifty cases at the Phipps Institute was as follows:

Right upper lobe	15
Left upper lobe	6
Right middle lobe	1
Right lower lobe	0
Left lower and both upper lobes	1
Left and right upper lobes	30
Total	76

In this series there was no instance of a primary basic cavity. This condition is rare, occurring in less than one per cent. of cases. Basic cavities in association with apical disease, however, are not uncommon, particularly where the disease is advancing rapidly.

The size of the cavities ranged from that of a cherry (one by one cm.) to involvement of nearly an entire lung. In estimating the number of cavities present, small communicating cavities have been considered as a single large excavation, recognizing, however, that com-

municating small cavities may originate separately and coalesce from ulceration of the intervening lung tissue, or they may be separate points of softening in a large caseous area. Clinically the effort was made to distinguish this type.

It is evident that a pulmonary cavity at the apex is almost certainly tuberculous and with the presence of tubercle bacilli is invariably so. In most cases of chronic tuberculosis there is a slight degree of dilatation and thickening of the bronchial walls, but it rarely happens that these dilatations are sufficiently large to give physical signs. In two of our cases cavity formation and marked bronchiectasis at the apex co-existed, giving the signs of a single large cavity.

Involvement of the pleura over cavities is very common. Dense pleural thickening occurred in sixty of the seventy-six cavities we examined. In the chronic forms this thickening is almost constant. In acute types of the disease and in the advancing areas of the chronic cases where the breaking down is rapid ulceration through the pleura, with a resulting pneumothorax, is not unusual. I have met with several instances in which the pleura had been perforated by an ulceration but the dense adhesions presented collapse of the lung. Rarely a cavity may ulcerate through the chest wall. In one case which I have seen this accident was prevented by a rib which had become markedly necrosed.

In comparing the clinical with the pathological findings in these fifty cases, it was found that of the seventy-six cavities present, fifty-eight had been recognized, while eighteen had escaped notice. The majority of the cavities not recognized were very small; three of them, however, had attained the size of a lemon (four by five cm.).

It is usually stated in the text books that a cavity must have attained the size of an English walnut before it will give signs sufficient for its recognition. The situation of the cavity, however, has a more important bearing on its recognition than its size. If superficially placed just beneath the pleura, cavities the size of a cherry (one by one cm.) will often give well marked signs, while much larger ones, deeply situated with a thickened pleura and normal and infiltrated lung tissue about them, will escape detection.

In the fifty-eight cavities which were correctly diagnosed, lack of expansion, retraction of the apex and flattening of the chest wall anteriorly was the rule. Bulging or fullness of the chest wall over the

site of the cavity was not met with, although I have seen this phenomenon once.

In those cases in which it could be elicited the tactile fremitus was exaggerated in thirty-four instances and diminished in thirteen.

The percussion note had a tympanitic quality in thirty-six; was dull in sixteen; hyper-resonant in three, and in three instances was of the cracked pot variety of tympany.

The breath sounds were noted as cavernous in twenty-nine; amphoric in nineteen; bronchial in thirteen, and distant and indefinite in seven.

There was an absence of rales in nine. When present they were noted as being fine and moist in sixteen, consonating in seventeen, and gurgling in sixteen.

Vocal resonance was exaggerated in fifty-one instances and diminished in but one.

Whispering pectoriloquy was present in fifty-three instances and absent in five.

In eight instances cavities were correctly diagnosed as being communicating, being only about one-fourth of those actually of that character. This was done by noting that the breath and voice sounds had several points of maximum intensity in conjunction with a large area of coarse bubbling rales with a metallic quality and symptoms indicating a rapid destruction of tissue.

The physical signs over those cavities (eighteen) which were not recognized were almost invariably dullness, bronchial breathing, and increase in both vocal and tactile fremitus and absence of whispering pectoriloquy. Most of these cavities were found in post-mortem to contain thick creamy pus. Failure in the others may have been due to a number of small openings rather than to one or two large ones. On this point, however, there are no notes.

In the ten instances in which cavities were believed to be present but which at post-mortem were not found, consolidated tissue around a bronchus was the source of error in five. In one there was no adequate explanation. In four the error was probably due to transmission of the amphoric breathing and whispering pectoriloquy from a cavity on the opposite side. In these four instances the cavities gave signs posteriorly only. Cavities as a rule give more marked signs anteriorly. Thus, of the fifty-eight under consideration, the signs were present anteriorly or anteriorly and posteriorly in fifty-five instances, while but three gave signs posteriorly alone.

From this analysis it is evident that our results were not as accurate as they might have been, particularly in the estimation of conditions simulating cavity formation.

So far as the recognition of cavities actually present was concerned the results were fairly good, as the majority of those escaping notice were very small and the conditions found post-mortem in a measure explained the cause of failure.

Basing the value of the various signs on the frequency with which each occurred, the following results were obtained:

Whispering pectoriloquy	53 out of 58
Tympany	39 out of 58
Cavernous or amphoric breathing	38 out of 58
Gurgling or consonating rales	33 out of 58

While whispering pectoriloquy was most frequently met with, it is not absolutely pathognomonic, as it was absent in eighteen instances with cavity formation, and its presence in five other instances led to a diagnosis of cavity when consolidation about a bronchus was the condition actually present.

In conclusion, it may be said that any one of the above signs is suggestive of a cavity and that the probability of its existence is increased by the combinations of any two or more of them.

DISCUSSION ON DR. LANDIS'S PAPER

Dr. William H. Welch, Baltimore: It is very interesting to consider these cavities which are peculiar to tuberculous processes in the lungs. There must be some conditions in the lungs which are not encountered elsewhere which lead to the formation of cavities. There are communications with the external air through the bronchi, which permits of the removal of necrotic caseating spaces, and also chemical considerations due to the ingress of air, which aid in breaking down the caseating material. As already pointed out, you can produce phthisis in animals by means of the mixed infection with the tubercle bacilli and the streptococci; whereas, cavities are rarely encountered in rabbits in pure infection due to the bacillus. This was experimentally demonstrated years ago before the Association of American Physicians by a gentleman who was very careful in drawing conclusions as to the necessity of a mixed infection in producing cavities in the human being. While I undoubtedly think that the mixed infection plays an

important part in the production of cavities, I do not think it has been proven that a mixed infection is always necessary in producing them. The pictures of tuberculosis prove it, too; these pictures of tuberculosis of the lungs and liver show that tuberculosis ends in cavity formation there and not in other parts of the body. Communications exteriorly through the trachea and inspired air causes an occurrence of a mixed infection and doubtless the action of the autolytic enzyme plays an important part in the disintegration of the necrotic material in general.

The forms of tuberculous cavities have been well described in the paper, but not sufficient emphasis has been laid upon the occurrence of the diffuse tuberculous condition, a condition Delafield always emphasizes. Here we have exactly the same histological elements which compose miliary tuberculosis and they may spread out over a large area, long considered an exudative inflammation. Here we have an admirable illustration of a diffuse tuberculous condition, the spread of the cavity being due to a gradual caseation of the diffuse tuberculous condition. On the other hand, it may be due to caseation of miliary conglomerate tuberculosis in the walls of the cavities.

I would like to say how interesting and valuable it is that one of the functions of this Association is the careful analysis and study of the different aspects of tuberculosis, as shown in the paper just read. Here there was made a careful analytical study which will lead to valuable contributions on this subject.

Our experience during the last few years has shown that the influenza bacillus is very common indeed in cavities in the lungs; we find it in bronchiectatic cavities, with or without tuberculosis. In the interior of these cavities nothing is more common than to find the influenza bacillus.

Dr. Alfred Meyer, New York: I should like to tell of a little practical point that is of value in the recognition of these cavities when the usual means fail us. It is simply a mechanical dodge. I think that most patients with tuberculosis will learn that assuming certain positions will cause them to cough; if they find that by lying on the right side they cough, they will not lie on that side. In other words, where you have cavities the contents of which are overflowing into the larger tubes and trachea and then expelled, you may get unmistakable evidence of cavity. Thus, where you suspect cavity formation you can get positive evidence of it if you will have the patient assume a certain

posture for a number of hours, or even days. Explain to him what you are after and, in this way, you may empty mechanically the cavity or cavities, and get unquestionable evidence of their presence. Recently I have had a child suspended by the ankles in order to empty an old bronchiectatic cavity. In a certain small proportion of the cases where no positive evidences can be obtained of cavity formation, this procedure, a purely mechanical one, will greatly assist you.

Dr. J. A. Miller, New York: I should like to ask regarding the occurrence of misleading signs of cavities, that is, where cavities suspected to be in one place, were found to be in another. I should like to know if it has been the experience of any present to make such a mistake. I remember two cases in which the autopsy revealed cavities in the upper lobes when cavities were supposed to be in the lower lobes in both instances.

Dr. John H. Pryor, Buffalo: I only wish to say a word. The finding of rales in cavities depends upon the time of day the lungs are examined. I am inclined to think that in recording rales in tuberculosis, whether of the cavities or of the tubes, that it would be a very wise thing to state the *time* the examination was made, whether early in the morning, or other time of day.

Dr. Abbe, Washington: I should like to hear something regarding the determination of cavities by means of the X-rays. The experience with this that I have had has been very favorable in that respect. By means of the X-rays we have often found a number of cavities which could not be determined by the ordinary methods of physical examination.

Dr. H. R. M. Landis, Philadelphia: The suggestion that Dr. Meyer has made I believe to be a good one and I have no doubt that some of the obscure cases can be diagnosed in that way. Certainly cavities the size of a lemon should give signs unless filled up; and if they are drained by the method suggested it is quite possible that they would give evidences of their presence.

With regard to the transmission of sound I think our experience will show that where cavities give signs posteriorly only not a great deal of reliance can be placed upon it.

We have had no experience with the use of the X-rays at our institution, although Pfahler of Philadelphia gave the staff a very interesting demonstration of it recently. Certainly his efforts were very convincing in showing that with the X-ray evidences of cavities could be obtained when the ordinary methods failed.

TUBERCULOSIS OF THE PLACENTA

By Alfred Scott Warthin, M.D.

Ann Arbor

Dr. Warthin presented a series of lantern slides which demonstrated cases of placental tuberculosis and gave a most interesting description of them. Dr. Warthin had given much attention to this subject and suggested that these instances of placental tuberculosis are more common than has hitherto been suspected.

DISCUSSION ON DR. WARTHIN'S PAPER

Dr. William H. Welch, Baltimore: I think we are all greatly indebted to Dr. Warthin for the valuable demonstration he has given us. It is really a subject of fundamental importance in the conception of the etiology of tuberculosis. The evidence which is accumulative since the time of Baumgarten' first statement of his views as to the congenital origin of tuberculosis has been along the road every step of which was ridiculed by pathologists. I think it must be seen that the evidence of placental transmission of tuberculosis is becoming stronger and stronger, and the views in support of this show that this is not so rare as once supposed.

I have been particularly interested in Dr. Warthin's study of the histological details and in one class reminds one of the experimental tuberculosis produced in the lungs by injecting a large number of tubercle bacilli directly into the circulation. This experiment was made to bring support to the views in opposition to Baumgarten's that the direct and primary action of the tubercle bacilli was to cause damage, chiefly in the form of necrosis. I never was satisfied with Baumgarten's position, that tubercle bacilli caused primarily a growth of cells, contrary to fundamental ideas. Therefore, I have been anxious to bring evidence that the tubercle bacilli primarily damaged the parts and the proliferation of cells was secondary to that. To do so, I think that

certain of the tuberculosis cases Dr. Warthin describes should be put to experimental test to show that primary necrosis is in the walls of the vessels and surrounding tissues. Perhaps polymorphonuclear leucocytes and fibrin will appear in the exudate. This is followed by a clearing up, to a large extent, of the exudate and a proliferation of cells. Baumgarten's position has not been confirmed by what is observed in nature and I can hardly conceive masses of tubercle bacilli acting as emboli and I should like to ask Dr. Warthin if this is not a condition not unlike those found in experimental cases where a large number of tubercle bacilli gain access to the intravenous blood spaces and causes an immediate necrosis of the cells in the immediate neighborhood to the cincidial cells covering the villi with an agglutinating thrombosis.

As regards the main point, I think that we must believe that it is unquestionably true that the tubercle bacillus can be conveyed from the mother to the fetus in utero and more frequently than it has been customary to believe. In the early cases no lesions are found in the placenta, but I do not think that it is necessary to have any special and definite lesions in the placenta to permit the passage of the bacilli from the mother to the fetus. In ordinary phthisis it is not unusual for the tubercle bacillus in small numbers to get into the circulation. If you make a careful autopsy in ordinary cases of consumption you will find here and there tubercle bacilli in the kidneys, in the spleen and not uncommonly in the liver. To me then the question arises why not find the tubercle bacilli in the new born infant? Here are two positions to be assumed. First, the entrance of the bacilli into the fetal circulation so late in fetal life that tuberculosis has not had time to develop. Secondly, the position based upon experimental data, that the fetus is relatively insusceptible. I think there is support for both views. I think the conditions must be favorable for the discharge of the bacilli into the fetal circulation towards the end of pregnancy and in the act of birth. But it is evident that time is required for the development of lesions in the placenta. The tubercle bacillus must be in the placenta a sufficient time to develop tuberculosis, provided the fetus had some susceptibility, the same that the body has after birth. I believe there is considerable evidence that the fetus can have tubercle bacilli without producing tuberculosis, and that they are present in the blood vessels of the fetus at the time of birth and that after birth they may produce lesions. We must acknowledge a direct conveyance of the tubercle bacilli from the mother to the fetus. I am not prepared to take the

same position as Baumgarten. A much larger percentage of the cases are of that origin than is supposed. I think this is an important line for investigation, and that further careful study of the placenta in cases of tuberculosis should be encouraged.

Dr. Lawrence F. Flick, Philadelphia: Clinically it is a remarkable fact that children born of tuberculous mothers often show a strong immunity to tuberculosis for at least months after birth. I have for years watched the offspring of tuberculous mothers and many of them are the healthiest children I have seen. I should like to ask Dr. Welch if it possible that this exposure to the tubercle bacilli in intra-uterine life may not confer immunity upon such children.

Dr. William H. Welch, Baltimore: I have had no experience in that matter, but it certainly would be gratifying to believe that children could be vaccinated *in utero*. This is a matter for clinical observation; it is a subject well worthy of clinical observation and study by all clinicians, that is, the behavior of the offspring of tuberculous parents. I do not know much that will support that view; there is no a priori reasoning against the supposition that immunity is produced in the fetus of tuberculous parent. Here we find living tubercle bacilli more resistant than in adults or individuals after birth and the conditions would seem to be seem to be favorable for the possible production of an active immunity. But I hesitate to make any definite statement without fuller knowledge than I now possess.

Dr. Mary E. Lapham, Highlands, N. C.: Children of tuberculous mothers certainly seem to possess an immunity, but it is a question as to how long this immunity exists. Children of tuberculous mothers very commonly live up to a certain age, and are apparently strong; then any extra strain placed upon them during their development, such as school life, etc., will cause them to go down much more rapidly than children of non-tuberculous parents. I think that it is generally admitted that as children of tuberculous parents approach the twentieth year, for instance, the percentage of children in which tuberculosis develops is very large, even after being apparently healthy and strong children.

Dr. Lawrence F. Flick, Philadelphia: I have not had a chance to watch the children of tuberculous mothers for twenty or thirty years, but I have knowledge of a number of men who were children of tuberculous mothers, the mother having died of tuberculosis perhaps within one year after the birth of the child and these men are of an unusual

type of well developed manhood. I have not had enough of these cases to draw conclusions from them, but I have had enough to raise the question of conferred immunity. I think this is a very interesting and important subject for study.

In studying this subject we should keep in mind that children of tuberculous mothers are born under conditions which subject them to severe strain and exposure to the disease. They sometimes have to withstand exposures during their entire lives and the wonder is that they can resist at all. It is surprising how well they resist infection, particularly when the mother is in an advanced stage of the disease and how well they withstand the development of the disease, when they get an implantation, under hardship and deprivation. I invite observation upon this subject. I have been making observations for ten or fifteen years and I believe that in these cases a relative, and sometimes a complete, immunity is conferred which stands good throughout life.

Dr. Edward L. Trudeau, Saranac Lake: The difficulty with which the tubercle bacilli pass from the mother to the fetus is more apparent than real; the bacilli lie dormant for days, months or even years. I was struck this winter in vaccinating cows with no lesions whatever, that at the end of one, two or seven months the bony marrow was affected but we could not find any tubercle bacilli.

Dr. Herbert Maxon King, Liberty: In 1901 I presented a paper at the Congress of Tuberculosis in London, the subject of which has a bearing, though an indirect one, upon the subject under discussion in that the paper contained statistics regarding some one hundred fatal cases of tuberculosis, a certain percentage of which were children of tuberculous parentage and who I found quite contrary to my expectations had an average length of life after the first demonstrable evidence of the development of tuberculosis 25 per cent. longer than was the case among such as had a non-tubercular parentage, showing, it seemed to me, that a very definite, though of course relative, immunity is conferred by the tuberculous parent upon the offspring.

Dr. John H. Lowman, Cleveland: I would not have ventured on a discussion of the question of placental transmission of tubercle bacilli and the consequent congenital tuberculosis were it not for the remarks of the last speaker (Dr. Flick) on the immunity of the children of tuberculous mothers. I apprehend from some studies on children that I have been making during the last year that the prevalence of tuberculosis among children is much greater than is generally supposed.

It is of course impossible to say from the facts whether the child is infected in utero or from its exposure after birth, although the presumption from our present knowledge is overwhelmingly in favor of the latter.

I have had three hundred children of tuberculous families examined and find that ten per cent. are tuberculous and ten per cent. are suspicious. This enormous ratio speaks too strongly against the immunity of such children. That an occasional member of such a family reaches manhood uninfected may easily be due to accident or to the occasional immunity that is supposed to exist in many people. In my studies we have not distinguished between the children of tuberculous and non-tuberculous mothers. It is too early to assume that the children of phthisical mothers have any immunity.

Dr. Lawrence F. Flick, Philadelphia: The statistics offered confirm what I have said, namely, that sometimes children of tuberculous parents are so immune that they do not give evidences of the disease, and that they have more resisting power than children born of non-tuberculous parents. Here are a lot of children without the appearance of being tuberculous and yet they were found to have tuberculosis. It remains to be seen whether they can throw off all evidences of the disease and grow to be strong and healthy men and women.

Dr. Alfred Scott Warthin, Ann Arbor: In reply to Dr. Welch I would say that there is no better demonstration of the primary effects of the tubercle bacilli in the way of necrosis than is found in the placenta.

There are a number of other interesting points, but I will refrain from taking them up.

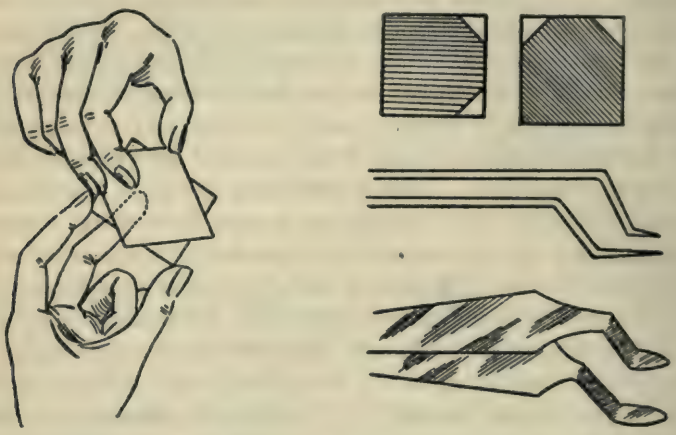
NOTES ON SOME COMMON ERRORS IN THE TECHNIQUE OF SPUTUM STAINING FOR TUBERCLE BACILLI.

By Chas. L. Minor, M.D., and Paul H. Ringer, M.D.
Asheville, N. C.

While the profession now realize very generally that the diagnosis of tuberculosis can, and often must, be made long before the bacillus can be found in the sputum, a failure to recognize which fact in the past led to many sad mistakes, and though today we appreciate that careful methods of physical examination are more important than sputum analysis, it is yet essential that when we resort to the latter our technique should be so accurate and our methods so good that we can rely upon our results implicitly. When one considers how often the negative results of a sputum examination are the basis for diagnosis and treatment, and how large a part the presence or absence of bacilli in the sputum plays in the statistical reports of individuals and institutions, on which our ideas of treatment are in the future going to be built, it is very evident that we cannot in this matter be too careful, and having become convinced by careful observation that a large amount of the sputum staining done throughout the country is unreliable when dealing with sputums of very low bacterial content, I trust I may be pardoned for taking some of your time to dwell upon what I believe to be some very common and harmful errors in this work as usually done. In this connection let me say that, since the results of such work largely depend upon the precision and accuracy of our technique, it seems to me unfortunate that the majority of our text books give very general and careless instructions for sputum staining. True, to demonstrate bacilli in a specimen swarming with them is a matter easy for the veriest tyro, but, on the other hand, to show them where they are very scanty needs precise, neat, careful work, and unless the work has been of this sort a negative report is of absolutely no value. Al-

though, as I have said, I have been convinced from observation that the method taught as generally applied allowed too much room for possible error to creep in, it is only recently that I have been able, with the aid of my laboratory assistant, Dr. Paul H. Ringer, to satisfy myself of the correctness of these ideas, as the result of the study of all sorts of modifications in the regular technique. While there are many satisfactory methods for demonstrating the germ, the Ziehl-Nielssen method, with carbol-fuchsin and methylene blue is both so generally known and if properly used so satisfactory in its results, that I have confined myself to notes on its use, and my remarks will apply to it. In the beginning I would assert and in this I am sure all will agree with me, that the essential of proper differential staining for tubercle bacilli in the sputum lies in a carefully carried out decolorization, and further, where bacilli are very few, such a proper decolorization can be rendered difficult or impossible to obtain, not only if the actual manipulations be carelessly done, but if the earlier step of the process, proper spreading, be not so carefully and well managed as to yield an even, smooth spread of a medium thickness, or if the preliminary fixing be carried too far. The steps of a sputum analysis which can affect the accuracy of our results are the spreading, the fixing, the primary staining, and the decolorization. The counterstaining, while adding to the clearness of the picture, has of course no essential place in the process. Spreading as very generally done is uneven, lumpy or streaky, which, of course, if many germs are present, could have no effect in preventing their discovery. If, however, they are very scanty, on the one hand, a thick streak, holding the stain en masse longer than the thinner portions, can hide under it an isolated bacillus, or, on the other hand, very thin portions can so quickly decolorize as to cause us to overlook an occasional single germ. To verify this Dr. Ringer has made spreads of varying thicknesses and we find that if made very thin it is only with the greatest care in decolorizing that they are not decolorized completely, even relatively short periods in the acid bath removing all color. Since, as I believe then, careful, very even spreading is important, and since it is with difficulty that on ordinary slides a proper smooth and even spread can be made—aside from the fact that slides are much more expensive than covers and that any slide on which a bacillus has been fixed and stained should never be used again—I believe that we should always make our spreads on cover glasses, as originally taught. This method has been largely

given up, because unless carefully handled covers are easily broken and because without proper methods one can thus soil one's fingers. If, however, it be gone about properly, covers (save for occasional defective ones) need never be broken and one's fingers need never be soiled.



The cuts appended to this article will, I trust, make clear the simple technique I have evolved. Having taken care that the mass of sputum chosen is not too large, as is generally the case, say not over one-eighth of an inch in diameter, and that it is placed just in the center of a clean cover, lay on the second cover catecornered, holding the lower one with the thumb and index finger of the right hand on two of its corners, while making pressure on its center with the ring finger of the same hand. The upper cover should be held by the thumb and ring finger of the left hand on two adjacent corners, with the index finger of the same for counter pressure. Now, making even pressure between the two pressure fingers, with slightly circular and marked longitudinal motion, draw the covers apart and slightly warm the two covers well above the Bunsen flame, thus drying the thinnest portion of the spread only; repeat the superposition, pressure and rubbing; again spread and dry, keeping up this (which I call "fractional drying") until the sputum is perfectly evenly and smoothly spread on the two covers. Anybody who will take the trouble to learn the technique of this simple spreading method will find that he will never soil his fingers, he will get even, satisfactory spreads of any desired thickness, and he can handle thus the toughest and most elastic sputum without

difficulty. Owing to the way in which they are drawn one cover shows a spread running from corner to corner, one from side to side, and each shows two generous corners free of sputum, by which they can be manipulated. As to fixing: the ordinary method used is by flaming, in the Bunsen burner or alcohol lamp, and as the Bunsen is ordinarily used, I refer to this only. Any method which subjects the glasses to a heat above 212°, or any chemical that will coagulate albumin, will satisfactorily fix it, so that the Bunsen is by no means the ideal fixing method, save for its quickness and availability. Care must be taken that the fixing is not too thorough, as a series of experiments with varying thicknesses of spreads and varying lengths of exposure to the flame have demonstrated to us that after you pass nine passages through the flame you can so affect the germ that it will not stain. However, in the usual number of times recommended, which is three passages through the flame, about as bread is cut, I find there is very little danger of overheating, six times giving a better result as regards stain indeed than does three.

As regards the staining proper, I would only say that ready-prepared bottles of stain are very apt to deteriorate, and that, as is sometimes the case, it is desirable that the alcoholic solution of fuchsin should be kept in one bottle and the five per cent. aqueous carbolic in another, and enough drops of the former be added to a watch-glass of the latter to produce a metallic shimmer, or "Spiegel," on the surface, which generally makes a slightly turbid solution, clearing at once on heating, too-weak solutions not working well. Again, if the usual rapid method of heating is used, although the slow cold method will produce even prettier results, it should be seen that your solution is brought to a real boil on the cover over the flame, and that the cover be set aside, with this hot solution upon it, for at least two or three minutes.

However, it is not in the staining that errors are apt to arise. For decolorization 20 per cent. to 25 per cent. aqueous nitric or sulphuric acid solutions were those originally recommended by the German workers developing these methods, and Dr. Ringer and myself have used 20 per cent. aqueous nitric in our experiments. My friend Dr. Ravenel of Philadelphia, whose large experience with the bacteriology of tuberculosis is well known, prefers a much weaker solution: five per cent. of acid in 90 per cent. of alcohol, and it seems to me that this would be distinctly superior, the alcohol in the mixture serving to remove doubt as to smegma bacilli and the weak acid content making

it impossible to over-decolorize, which is the cardinal error generally made. If this solution were used under careful control of the eye there should be few mistakes made in the decolorizing of the bacillus. If the usual stronger aqueous acid solutions are used we have found that it is very easy to totally decolorize specimens in which there are a few isolated germs. The only safe way with these solutions is to have water and acid solution side by side, with a white background; to keep the spread in the acid not over one second, removing it quickly to the water and studying the color remaining, repeating immersions of a second's duration, with rapid washings until the exact shade taught by experience is reached, that peculiar faint pinkish pearl gray which we all know. Unfortunately, some of the various methods which combine decolorization with counterstaining are very popular and recommended even in good works, and I do not hesitate to state that all such methods are absolutely unreliable and unsatisfactory. The decolorization varies so greatly in rapidity both with the thickness of the spread and the intensity of the fixing, as well as the nature of the sputum, that it is impossible to get proper and uniform results unless the procedure is carefully checked by the eye. Some specimens will decolorize at once with one quick immersion, some can be put back again and again before a proper decolorization is reached, and anyone who will take the pains to make a large series of spreads of various thicknesses and times of flaming and subject them to various lengths of decolorization can readily satisfy himself of the correctness of my statement. In a properly spread cover properly handled we can feel sure that we will not decolorize an occasional isolated bacillus and so overlook it, but this security, so essential to the reliability of our results, cannot possibly be had if a combined method is used or long careless immersions in acid solutions allowed. The safest of all decolorizers, but a very slow one, is alcohol. The ordinary strong acid alcohols used in histology are much too strong in their effects; the weak acid alcohol recommended by Dr. Ravenel seems to me a good suggestion and worthy of careful trial. A small point, yet one worthy of attention, is that the cover should be immersed in the solution parallel to the plane of the solution, the acid thus flushing the whole surface at once and the decolorization being therefore equal all over. If put in slantingly, as is generally necessary when ordinary forceps are used, it is evident that one portion will get a longer immersion than another. Special forceps allowing of this I have never seen. I devised one of

my own in Munich in '91, which can be made by any intelligent metal-worker and an illustration of which is appended. Another small point worth noting is that the cover is frequently mounted before the film of sputum is totally dried from the last water bath, the opacities resulting having a bad effect upon the visibility of the film.

It is not pretended that anything that has been said here is new or original. The control experiments of Dr. Ringer and myself as carried out, and which I have not reported seriatim as I did not think the matter important enough, convinced us of the ease with which apparently slight errors will cloud the perfection of our results, and I trust that anyone interested will make a trial as we did of the effect on results by varying thicknesses of spread, length of fixing and time and method of decolorization. I only advocate, therefore, the careful carrying out of a systematic method well tested and neatly done, because until it is thus done we can have no assurance that our information as to the absence of bacilli from any sputum is accurate and because on the accuracy of such reports depends very often our classification of cases on discharge. If I shall succeed in increasing the care and precision with which this branch of clinical diagnosis is carried out, I will feel that my effort has not been in vain.

DISCUSSION ON PAPER BY DRS. MINOT AND RINGER

Dr. Wm. Krauss, Memphis: I was particularly interested in Dr. Minor's paper because I read a paper on the same subject one month ago. There is naturally a tendency to drift into routine and in our development of overconfidence we get careless about the steps taken in reaching results. It is apropos to speak of the reckless manner in which men send specimens of tubercular sputa, etc., improperly packed, through the mail. This makes one shudder thinking of what might happen. It is true that sputa dry into a more or less glutinous mass, but still the danger lurks.

With regard to the statement about decolorization being the only source of fallacy I wish to take exception. Frequently the sputum is old and the basic element in the solution is not strong enough to neutralize the fatty acids formed.

The method of fixation which has been most useful to me and most satisfactory is the use of an electric hot plate which can be heated to the right temperature and which retains its heat quite long and is not liable to scorch the specimen.

I particularly like to stain with crystal violet, saturated alcoholic solution, added to one per cent. carbonate of ammonium in water, using 2 c.c. or 3 c.c. of the latter, dropping into it a few drops of the crystal violet. After steaming for one minute the smear is washed with water, then with one-half per cent. eosin in eighty per cent. alcohol, using no acid at all. This brings out the structure of the bacillus well without incrustation, and the counterstain does not interfere with the observation of degree of decolorization. I heartily endorse Dr. Minor's stand on the great importance of spreading evenly between two glass surfaces.

Dr. Chas. L. Minor, Asheville: If the gentlemen who have listened to my very sketchy remarks will take the trouble in their laboratories to go through a small series of experiments of the sort I have roughly reported on, I believe they will find that I am right in claiming that, as generally done, there are too many sources of error in our sputum examinations and that such errors can make worthless the reports that we ordinarily rely upon as to the presence or absence of bacilli in any given specimens of sputum.

CONCERNING BACILLUS X

By Stephen J. Maher, M.D.
New Haven

Ten years ago in the course of an investigation that I made in Holland, I learned to my surprise that there was less tuberculosis among the Dutch than among many other peoples living in higher and drier lands; that a large proportion of the cows of Holland were tuberculous; that the milk from these largely tuberculous cows was made into the cheese which in many of the farming and fishing villages was the most important food of the people; that despite the fact that the housing of the people in these damp towns was of a very primitive order, human tuberculosis was surprisingly infrequent. I asked myself: Are these people developing immunity by eating cheese made from the milk of tuberculous cows?

Thirty months ago I published a report of my experience of several years in treating tuberculous patients by hypodermic injections of live cultures of a spore-forming bacillus that I called Bacillus X that I had found in pure cultures in the whey left after simple hand-cheese had been made from tuberculous milk. This bacillus has been authoritatively identified as Bacillus Mycoides III. I still prefer to speak of it as Bacillus X. My reasons, I hope, will be plain before I finish my paper.

Bacillus X is a facultative aerobe which in its ordinary form grown in plain bouillon consists of a rod not much longer than an average tubercle bacillus, but three to five times as thick. It swells to twice its size in milk and develops filaments, and on potato and agar runs quickly to spores which with the Ziehl-Nielsen stain are sometimes untinted and sometimes red.

In young cultures the rod stains entire with methyl blue as well as with the differentiating stains and usually is Gram positive, digests milk, turns it a cafe au lait color and renders it alkaline. It softens gelatine. It produces a moist colorless or faintly brown growth on

Loeffler's serum which slowly digests the medium and after eleven days at thirty-seven degrees is filled with white tubercles, sometimes larger than a pin head and sometimes much smaller. It forms a white scum on plain bouillon and glycerin bouillon. For a detailed description I must refer to my first paper.

Two years ago I was puzzled by finding at the bottom of some bouillon cultures that had been kept sealed at room temperature for eight weeks many acid-fast shapes. They were not perfect rods, but they were more like rods than spores. They were similar to many of the acid-fast forms found in smegma, or in ear-wax. I tried in vain to separate the reds from the blues. All my subcultures and poured plates gave me pure X. I dropped the matter until last October when on my return from my vacation I again found acid-fasts in the sealed bouillon tubes, which in August had contained only non-acid-fast X rods. My efforts during the year to solve the mystery of the origin of these acid-fasts has led me to conclusions which I think are important, and which I would respectfully lay before you. In brief they are: First, prolonged cultivation in sealed tubes or flasks of bouillon, sugar bouillon, or equal parts of sugar bouillon and normal salt solution profoundly changes X. For instance X taken from a growth on serum and grown in sealed bouillon for six days at thirty-five degrees, kept eleven days at room temperature, subcultured in sealed sugar bouillon two days at thirty-five degrees, eleven days at room temperature and after the addition of an equal amount of normal salt solution kept at thirty-five degrees for eight days will be found to contain not a single X rod. The growth will be found to be a pure culture of biscuit cocci which by appropriate subculturing can be kept as cocci for an indefinite time, but which if planted at first on agar or Loeffler's serum will promptly return to X rods and spores. The various stages of the transformation, the swelling of the rods, the appearance in them of coccal granules, the increasing prominence of these granules, and finally the disappearance of the enclosing rod, can be easily followed with the microscope. These cocci have not only different shapes but also different properties from their mother rod. For instance, instead of digesting milk and rendering it alkaline, they curdle milk and turn it acid. They give a very faint non-digesting growth on blood serum, and their colonies on agar are as thin and weakly blue as those of pneumococci or meningococci. In the first plantings on agar or Loeffler's serum from the salted sugar bouillon

these cocci will grow into rods again, but after one or two subculturings in the bouillon, they may be readily grown as cocci on agar and all other media but one. That one is hard sheep's blood, not the serum only but the whole blood, without admixture of any kind. On this medium the cocci develops again into rods, but into rods that are unlike X rods in many ways. They are Gram negative and with the Gabbett stain are empty blues with polar beads usually. The striking resemblance of this coccal form of X to the pneumococcus and the meningococcus tempted me into this little experiment. On March 17 I injected intraperitoneally one large Belgian hare with twenty minims of a month-old room-temperature bouillon culture of these cocci and another with the rod derivatives of these cocci from a softening whole blood tube still growing at 35°. On April 23, I injected into both of these animals and into two controls, twenty minims of thin, slightly rusty spittle from an old pneumonia patient. The first control died in twenty-three hours; the second in twenty-four hours; the animal that had received the preliminary injection of cocci died in forty-seven hours; and the animal that had received the preliminary injection of derived rods was sick for four days but finally recovered, and is still alive and well.

On April 30 I injected four rabbits with a mixture of cocci and rods from whole blood cultures, and on May 8 injected pneumonic spittle into the same rabbits and into four controls. Both sets died in the same time.

Second, if Bacillus X be planted in tubes containing equal parts of normal salt solution and sugar bouillon and these tubes be kept at room temperature for one month, and if at the end of a month the contents of these tubes be added to an equal amount of normal salt solution and the new mixture be kept also at room temperature but sealed, smears taken at the end of seven days will show that instead of the normal X rods that were originally planted, and instead of the swollen halves of rods that were in the sugar bouillon plus salt solution at the end of the first month, there will now be found almost a pure culture of large ovoidal cells indistinguishable from the cells of ordinary saccharomyces cerevisiae, but which will neither convert starch nor ferment sugar. If subcultures be made on plain bouillon, kept at room temperature, a pure culture of yeast cells will be found at the end of forty-eight hours. If this growth be subcultured on plain bouillon, sugar bouillon, milk and agar, and if these tubes be kept at room temperature, pure yeast

cells will be found in all but the agar tube where only plain X rods, or spores, according to the age of the cultures, will be found.

If similarly planted tubes of bouillon, sugar bouillon, and milk and agar be kept in the incubator instead of being put at room temperature, no yeast but only X rods will be found at the end of twenty-four hours. On agar the rods will, of course, be sporing or spored.

Third, granular rods of X taken from an old sealed bouillon culture and planted in plain bouillon will frequently give, after variable periods at room temperature, a small reddish growth at the bottom of the tubes or flasks. This growth will be found to consist of masses of cocci, often enclosed still in a faintly outlined rod, but oftener without any visible wrapping. Many of the coccal forms will be found to be acid fast. Sometimes the acid fasts will be one in a line of three or four, while the other three or two will not be acid fast. Sometimes all three or four cocci will be acid fast. After another subculturing on bouillon this variety of X, which for convenience I have called A-X, may be planted on other media, and its characteristics will be preserved on most of them even at blood temperature. Some of the remarkable characteristics of A-X are: It has no more effect on milk than the tubercle bacillus. It grows at room temperature. It does not digest Loeffler's blood serum. It sends beautiful rod-like colonies through plain and sugar gelatine, but does not soften either medium. On glycerin agar and sometimes on plain agar, the colonies are white instead of red. Sometimes a culture young or old will not show any acid fast individuals; but even this kind of culture will crackle in the flame like tubercle bacilli. If fresh bouillon be added to old cultures they will revert to rather large ordinary X shapes. On potato it is difficult to keep it from becoming ordinary X. On glycerin agar it frequently grows into plain X. Subcultures on liquid media from solid media tend to return to X.

Poured plates usually produce X only. A-X is not pathogenic to rabbits and in my experience does not produce even pseudo tubercles after intraperitoneal injection.

Fourth, X may be made to develop acid fasts by several procedures, but in all of them, so far as my experience goes, it has been necessary that it be grown in media containing a goodly proportion of sodium chloride. What the minimum and maximum amounts are I have not attempted to fix. When I speak of normal salt solution, I mean a solution of six grams to the litre. If X be planted in bouillon, kept at 35°

for twenty-four days and an equal amount of normal salt solution be added and the mixture be kept sealed at room temperature for seventeen days and this be subcultured into milk tubes, sealed or not sealed, at the end of five days in the incubator there will be found clumps of beautiful acid fasts in fields of non-acid fast rods and cocci and ovoids. If the milk tubes be sealed during their five days in the thermostat, the acid fasts will have pronouncedly better rods than if they were not sealed. This same result, the production of acid fast forms of X may be secured by growing the original at 35° in equal parts of milk and salt solution for a month to six weeks and then adding other equal parts of salt solution and keeping sealed at room temperature for three weeks before subculturing into the milk tubes.

Acid fasts resembling most closely tubercle bacilli I have secured by taking X from a poured plate, growing it for three two-weeks' subculturings in plain bouillon at 37° and putting the last culture at room temperature for two weeks in a sealed ground-glass stoppered bottle with twice as much normal salt solution.

Poured plates from any of these acid fasts—containing cultures—will give only one kind of colony and this colony will contain only non-acid fast rods, apparently of plain X. Subcultures from these plates on ordinary media will, with one exception, give at 37° only X. The excepted medium is milk. This, although becoming slowly digested and alkaline as if it had been planted with plain X, will be found after five or six days to contain many thick acid fast rods and cocci and ovoids, besides different forms of granular or filamentous X rods. I have found it impossible to separate the acid fasts from the blues. The combination I have called Salt X or S-X. It presents an entirely different picture from A-X, as may be seen by comparing Nos. 39, 40 and 41 with Nos. 20–25.

It resembles A-X in this that it does not digest gelatine, and it differs from A-X and all other kinds of X in that it is capable of producing even fatal tuberculosis in rabbits.

My first experiment in this line was not in the expectation of causing serious disease in the rabbit but in the hope of recovering the acid fasts unmixed with the blues. On March 25, I injected two large, vigorous hares, one with twenty minims of a week-old glycerin-bouillon culture of A-X, and the other with a similar amount of a salted bouillon culture of S-X that had been standing at room temperature for nearly three months. Sixteen days later I killed both hares and the two controls.

All four hares showed a slight coccidiosis. The controls and the A-X hare showed nothing else abnormal. Smears and cultures from liver and spleen were negative. The S-X hare had soft, cheesy nodules in omentum and liver and a caseous caverned right lung. Smears from the pus of the lung and of the peritoneal tubercles revealed perfect slender granular isolated tubercle bacilli, and no other bacterial forms. Cultures from the pus of the lung gave nothing. Cultures from the pus of the omental tubercles gave on glycerin agar and glycerin bouillon and milk, characteristic S-X growths. After five days the acid fasts in the milk cultures had well developed into thickish rod shapes. On April 22, I injected intraperitoneally twenty rabbits with various strains of S-X; four with the culture used in the experiment just described; four with a salted milk culture of the S-X recovered from the cheesy pus of the tuberculous hare; four with a sugar bouillon subculture from this milk culture; four with a subculture of the original S-X on salted but unsterilized yolk of egg; two with S-X derived originally from salted milk; and two with S-X derived from a plant on plain milk from salted bouillon. Ten rabbits were kept as controls.

The first of the thirty to die was one that had been injected with the S-X from salted milk. It lived eleven days. It had twenty tiny grey nodules in the liver and one omental tubercle containing cheesy material. In this I could find no bacilli of any kind on smears, but planted on milk and on glycerin bouillon and on glycerin agar, it gave a pure culture of S-X, half acid fast and half not.

The second death occurred on the sixteenth day and was in the series injected with the S-X recovered from the pus of the hare autopsied weeks before. A giant tubercle of the size of a plum was found in the liver. A few faint small granular acid fasts were found with difficulty in the soft cheese contained in this tubercle. At first I was unable to grow any kind of organism from this pus, although the disintegrating lymphoid cells planted on glycerin agar showed very plainly a content of granular rods after six days in the incubator. On the seventh day these rods were free and developing as S-X clumps.

On the sixteenth day I killed two controls and one out of every series in which there had been no deaths. The controls showed no signs of tuberculosis and gave no S-X on culture. The rabbit injected with original S-X had tuberculous mesenteric glands and omental nodules in which perfect tubercle bacilli were found and from which perfect S-X was cultivated. Smears and cultures from the other ani-

mals were negative except that the tubes of milk in which the spleens of the animals had been dropped all contained S-X but with only a very few acid fast granules.

On the twenty-first day, the second of the rabbits injected with S-X from salted milk died. On autopsy I found inflamed kidneys and a stricture of the aesophagus. Otherwise all the organs seemed healthy. There remain alive after twenty-three days thirteen injected rabbits and eight controls.

Of course the criticism of any such work as I have described here will be "Contamination." And I do not expect to be able to persuade everybody immediately that contamination has nothing to do with these metamorphoses of my innocent X rods and spores into acid-producing cocci, into rounding homogeneous yeast shapes, and into harmless and harmful acid fasts. But I would respectfully ask the sceptical to consider: First, normal X is not only one of the fastest growing but one of the hardiest of germs. If planted with cocci, or yeasts or acid fasts or molds on ordinary media, it will continue to grow, heedless of these other organisms and often destroying or inhibiting the development of the other organisms.

Second, all these new forms of X can be readily returned to rods and spores of X. The cocci, by the addition of fresh bouillon to old cultures on bouillon agar and blood serum; the acid fasts by quick subculturings in plain bouillon; the yeast shapes by increasing the temperature. The return of these different forms is readily followed on smears.

In conclusion I would call your attention to these easily demonstrable facts:

1. Normal X or Bacillus Mycoides III, an organism that is obtainable often in pure culture from vaccine, from wintry mountain air, from green grass, from the needles of the pine and the leaves of the balsam firs and hemlocks in the depths of the forests, this bacillus that in its ordinary form may be with impunity injected alive into man or brute can, by subjecting it for prolonged periods to the inhibiting effect of its own excretions and to the nuclear or spore stimulation of weak salt solution, be forced to take on new forms and new properties, and these new forms, by careful cultivation can be made to persist.

2. In one of these new forms, this organism becomes largely acid fast, can cause the production of caseating masses in injected rabbits.

3. From these caseous nodes, in which are to be found on smears,

either no bacteria or only acid fast rods or cocci, may be grown the mixture of acid fast and non-acid-fast rods and cocci that were injected into the animal weeks before.

4. Cultures in sugar-bouillon and normal salt solution of this partly acid fast and partly non-acid fast organism will on injection into other rabbits cause the development of caseous nodes in the second series of animals.

DISCUSSION ON DR. MAHER'S PAPER

Gen. George M. Sternberg, Washington: I only rise to say a word or two in reference to the remarkable results Dr. Maher has obtained. It seems to me that we will surely have to have such results carefully controlled before they are accepted by bacteriologists today. Fifteen or twenty years ago we frequently had reports of the polymorphism of bacteria, but when spore-forming bacilli and micrococci were found in the same cultures this could generally be ascribed to imperfect technique. In fact the suspicion that the different forms observed resulted from impure cultures rather than from polymorphism was generally well founded.

Dr. T. E. Oertel, Augusta, Ga.: I have recently had exceptional facilities for using the cultures of the Bacillus X in the treatment of pulmonary T. B. and I have been using them for some time. One year ago I reported seventy-three cases to our State Medical Association in which I used this cultural measure. Sixty-three of them were crazy negroes in the State Sanitarium for Insane, having poor surroundings and mental conditions varying from acute mania to chronic melancholia. They were in all stages of tuberculosis except the first stage. I simply reported my findings and drew no conclusions. Of these seventy-three cases there were nine apparent cures in which the physical signs as well as the symptoms disappeared; three of these were outside cases, one being incipient, the other two well advanced. All three cases remain well today. Of the cases at the State Institution there are three that I know of that are well today. One was a glandular case, and she had had tubercular glands for years, with discharging sinuses, and was, too, an epileptic and fool. After four injections about three weeks apart, in the neighborhood of the enlarged glands, they all disappeared and she remains well today.

I mention these cases because they are of great interest to me; if these injections had brought about such changes and under such environment, it seems to me that this is a matter of some importance and quite worthy of our consideration.

FURTHER NOTES ON THE SERUM DIAGNOSIS OF TUBERCULOSIS

By Hugh M. Kinghorn, M.D., and David C. Twichell, M.D.
Saranac Lake

(From the Saranac Laboratory.)

At the meeting of the National Association for the Study and Prevention of Tuberculosis held in Washington in May 1905, one of us reported the results obtained with the serum diagnosis of tuberculosis. The method used was that of Arloing and Courmont, and their A homogeneous culture was employed.

Of the sixty-two cases tested, forty-three had pulmonary tuberculosis, seven were more or less suspicious as having tuberculous disease, and twelve were apparently in sound health. Of the forty-three tuberculous cases, seventy-nine per cent. reacted positively; of the seven suspicious cases, all reacted positively; of the twelve healthy persons, nine reacted and three failed to react.

The provisional conclusions drawn from these results were: 1. That in far advanced cases with very extensive or virulent lesions the serum reaction is generally absent.

2. That the reaction seems to appear most often with the most favorable cases.

3. That a certain number of favorable cases with well marked signs of disease fail to show any agglutination.

4. That in the tuberculous cases the average agglutinating power is one to ten.

5. That nine out of twelve healthy persons agglutinated positively.

6. That from these results no reliance was placed on the serum test as being a sure and reliable one for the presence or absence of clinical tuberculosis.

The number of healthy cases tested was too small from which to draw definite conclusions. Further tests were therefore made, not only

with serums obtained from healthy persons, but also with serums obtained from tuberculous patients, and from those with other diseases. Dr. David C. Twichell became associated in this work and the total number of cases tested by us was 247.

All the tests were made according to the directions of Paul Courmont. His A homogeneous culture was used throughout. It was grown in a bouillon consisting of,

Peptone (Witte)	20
Sodium chloride	10
Glycerin	40
Water	1,000

This was neutralized with normal soda solution. This formula was given by Dr. Courmont, but differs from his in that Witte's peptone (German) was used instead of Dufresne's (French peptone).

For several months we were unable to make any tests, as the cultures could not be agglutinated. We wish to thank Dr. Mazyck P. Ravenel for helping us out of this difficulty. At his suggestion we planted from agar into broth, and we then found that the cultures could be agglutinated in the proper way. The value of this method was still further increased by making use of the suggestion given by Dr. E. R. Baldwin. He advised planting from a potato culture containing six per cent. glycerin into broth. As a result we have had no further trouble. Our routine plan now is to plant from a potato culture with six per cent. glycerin into four bottles, each one containing twenty-five c.c. of broth, and not to plant from broth to broth. We have no difficulty in always having at least two out of four cultures at standard strength. This method removed the chief difficulty which has always been experienced by those who have used the serum diagnosis for tuberculosis.

To standardize the cultures we took four bottles planted on the same date, and of about the age of one month, and tested them with the standard serum. In making the dilutions we took one c.c. of culture and diluted it with 40 c.c. .85 sodium chloride. This gave a slightly milky emulsion. The standard serum was obtained from cow number five belonging to the laboratory, and when diluted with two parts of normal salt solution it agglutinated at one to thirty-three the homogeneous emulsion thus prepared. If the standard serum agglutinated the culture above or below one to thirty-three, it was not at standard strength, and was not used for the test. Every test was controlled

by using the standard serum. We wish also to say that the tests made on healthy serums were uniformly distributed throughout our work, and were intermingled with the tests on tuberculous serums. At the suggestion of Dr. Trudeau the results of the tests were always recorded on paper before reference was made to the names of those persons whose serums were tested. In this way we were entirely unbiased in our judgments, and did not know which were the healthy and which were the tuberculous serums.

Clear fresh human serum was used, and was obtained either from the lobe of the ear, or from a vein in the arm. With each serum, mixtures of different strengths were prapared at one to five, one to ten, one to fifteen, and so on; thus,

.2 of serum .8 of emulsion of broth culture (1–5)
.1 of serum .9 of emulsion of broth culture (1–10)
.06 of serum .94 of emulsion of broth culture (1–15)
.04 of serum .96 of emulsion of broth culture (1–25) etc.

When agglutination took place in a dilution of one to five the reaction was considered positive. The time limit given to the test was five (5) hours—not more. The tests were made at room temperature. Agglutination was observed by the naked eye up to five (5) hours. Results were considered positive only in those tubes which showed well marked flocculi easily visible to the naked eye, and with subsequent sedimentation and clearing.

Results.

The total number of cases tested was 247. Of these, seventy were persons in apparently good health; 155 were patients with pulmonary tuberculosis; twenty-two were patients with doubtful tuberculosis or with other diseases.

Of the 247 cases, 212 reacted positively = 85.82 per cent., thirty-five failed to react = 14.18 per cent.

Of the seventy healthy persons, fifty-nine reacted positively = 84.28 per cent., eleven failed to react = 15.72 per cent.; of the 155 patients with pulmonary tuberculosis, 135 reacted positively = 87.09 per cent., twenty failed to react = 12.91 per cent.; of the twenty-two patients with suspicious signs of tuberculosis and with other diseases, eighteen reacted positively, four failed.

The seventy healthy persons whose serums were tested were in apparently sound health. Their occupations of course differed widely.

Most of them belonged to the better classes of society. There were also Adirondack Mountain guides, painters, physicians, nurses, and commercial travellers. Some of these persons had been exposed to patients who were suffering with pulmonary tuberculosis. We did not make a physical examination of the lungs, nor did we test these persons with tuberculin. They were all, however, in apparently sound health. From the figures given above, it is seen that of seventy healthy serums 84.25 per cent. agglutinated positively, and that 15.72 per cent. failed tc agglutinate. The larger the number of healthy serums tested the higher the percentage of positve reactions rose, and it seems to us that this percentage would be higher if we had tested a larger number of healthy persons. The average strength of agglutination in these cases was one to 13.67. The agglutinations varied from one to five to one to 100. The serum which agglutinated at 1–100 was from a very healthy young woman of fine physique and of athletic habit. She was the widow of a patient who had pulmonary tuberculosis.

Of the 155 patients with pulmonary tuberculosis, 135 reacted positively = 87.09 per cent., twenty failed to react = 12.91 per cent.

These patients differed very widely as regards the extent and gravity of their disease. A few were latent or healed cases, and were either known to have had the disease at a previous time, or had physical signs of latent tuberculosis. The cases which reacted positively to the tuberculin test had either physical or rational signs which pointed to tuberculous disease, but it was necessary to use the tuberculin test to confirm the diagnosis. These cases are classed with the tuberculous patients. The advanced and far advanced are classified together, as it is very hard to rigidly classify some of the patients.

Of the five latent or healed cases, four reacted positively, one failed to react; of the seventeen patients which reacted to the tuberculin test, seventeen reacted positively = 100 per cent. The agglutination of these cases was always tested before the tuberculin was given.

Of the thirty-eight incipient cases of tuberculosis, thirty-six reacted positively = 94.73 per cent., two failed to react = 5.27 per cent.; of the ninety-five advanced and far advanced cases, seventy-eight reacted positively = 82.10 per cent., seventeen failed to react = 17.90 per cent.

It is seen that all the cases that reacted to the tuberculin test, also reacted to the serum test. In a certain number of these, the agglutination was tested before the tuberculin was given, and from eight to twelve days after the tuberculin reaction, in order to see if any in-

crease in the agglutination occurred from the tuberculin reaction. Some of the serums showed an increased agglutination after the tuberculin reaction, other serums remained the same. The cases tested in this way were too few to allow us to come to any definite conclusions. The average agglutination of these tuberculin cases was one to nineteen, and the variations were from one to five to one to seventy-five.

Of the thirty-eight incipient cases of pulmonary tuberculosis 94.73 per cent. agglutinated positively and 5.27 per cent. failed to agglutinate. The cases that failed to react to the serum test had physical signs of pulmonary tuberculosis, and tubercle bacilli in their sputum. In one of these cases it was necessary to inoculate a guinea pig with the sputum before tubercule bacilli could be demonstrated. The pig developed tuberculosis, and tubercle bacilli were found in the spleen. At a later date the serum of this patient showed well marked agglutination at one to five. The average agglutination in the incipient cases was one to 11.15 and the variations were one to five, and one to thirty-three.

Of the ninety-five advanced and far advanced cases 82.10 per cent. reacted and 17.90 per cent. failed to agglutinate. The average agglutination in these cases was one to 12.17, and the variations were between one to five, and one to seventy-five.

Of the twenty-two remaining cases, eight patients had suspicious signs of tuberculosis, but no definite diagnosis was made, and they were not tested with the tuberculin test. Six of these eight cases reacted and two failed. Of six persons who were subject to attacks of bronchial asthma, six reacted. Two patients who gave a history of pleurisy both reacted. One case of tuberculous glands of the neck did not react. One case of tuberculous meningitis in a child did not react; the spinal fluid was tested. One patient with cellulitis of the finger reacted, as did also one case of suppurative otitis media, and also one case of pregnancy.

In comparing our work with that of Dr. Paul Courmont we wish to state again that we followed his directions in every detail, and that we used the A homogeneous culture of Arloing and Courmont in every test. The only variations that occurred were that we used Witte's peptone instead of Dufresne's peptone, and that we transplanted from a potato culture into broth, instead of from broth to broth. The tuberculous cases tested by Courmont were mostly taken from the services of Professor Bondet and Professor Tesseire at the Hotel Dieu at Lyons, France. Our tuberculous cases were all taken from patients who were

undergoing climatic treatment for tuberculosis in the Adirondack Mountains. This explains why the average of our agglutinations is higher than that of Courmont, namely one to 14.82 for us, and one to ten for Courmont. Our patients were thus under the very best hygienic and climatic conditions, while Courmont's were mostly confined to a hospital.

In clinical cases of tuberculosis, Courmont obtained, 87.9 per cent. of positive reactions, 12.1 per cent. of negative reactions; while we obtained, 87.09 per cent. of positive reactions, 12.91 per cent. of negative reactions. In persons apparently in good health Courmont obtained, 26.8 per cent. of positive reactions, 73.2 per cent. of negative reactions; while we obtained, 84.28 per cent. positive reactions, 15.72 per cent. negative reactions.

As mentioned above, the larger number of healthy serums tested, the higher the percentage of reactions rose. In our judgment there is little if any difference between the agglutinating power of healthy and tuberculous serums, namely 84.28 per cent. for healthy and 87.09 per cent. for tuberculous serums. The average agglutination is also practically the same, namely 14.82 for tuberculous patients and 13.67 for healthy persons.

TABLE

	Total Number.	Reacted.	Failed.	Av. Agglutination of the Reaction.	Lowest and Highest Reaction.
		Healthy Cases.			
	70	59 = 84.28%	11 = 15.72%	13.67	5–100
		Tuberculous Cases.			
(*a*) Latent and healed	5	4	1	21.5	10–50
(*b*) Tuberculin test.	17	17 = 100 %		19	5–75
(*c*) Incipient.	38	36 = 94.73	2 = 5.27 %	11.15	5–33
(*d*) Advanced and far adv.	95	78 = 82.10	17 = 17.90	12.17	5–75
Total	155	135 = 87.09	20 = 12.91	14.82	5–75
		Other Diseases.			
Suspected cases	8	6	2	10.83	5–15
Asthma	6	6	0	14.66	5–33
Bronchitis	1	1		33	
Tuberculous glands of the neck	1		1		
Tuberculous meningitis	1		1		
Cellulitis of finger	1	1			15
Suppurative otitis media	1	1			15
Pleurisy	2	2			15
Pregnancy	1	1			25
	22	18	4	12.31	5–33

Conclusions.—From our investigations we must conclude that the serum diagnosis of tuberculosis as used by Arloing and Courmont is not a specific sign of the presence of clinical tuberculosis, since healthy and tuberculous serums have practically the same agglutinating property. We therefore conclude that the serum diagnosis of tuberculosis, and especially for the early diagnosis of tuberculosis, is of no value.

THE TECHNIQUE OF THE TUBERCULO-OPSONIC TEST

By Hugh M. Kinghorn, M.D., and David C. Twichell, M.D.
Saranac Lake

(From the Saranac Laboratory.)

According to Professor A. E. Wright, the phagocytic effect obtained when bacteria are introduced into the blood is dependent upon an action exerted by the blood fluids directly upon the microorganisms. He speaks of this action, which prepares the microorganisms for phagocytosis, as an opsonic action (Latin: opsono, I cook, I prepare pabulum for). It is due to the presence in the blood fluids of substances he calls opsonins. Opsonins for tuberculosis are substances which modify tubercle bacilli in a manner which renders them an easy prey for the phagocytes.

The following observations have been made by Professor Wright and Captain S. R. Douglas:

1. Opsonins are contained in the blood fluids—serum or plasma.

2. They lose their power when heated to sixty to sixty-five C. for ten to fifteen minutes.

3. They exercise their influence by effecting a modification in the bacilli, and not by exerting a direct stimulating effect upon the phagocytes.

The object of this paper is to discuss the technique of the method used in estimating the opsonic power in the blood of tuberculous patients, and also of those undergoing tuberculin treatment, and to record our experience with it. Briefly, the method employed by Professor Wright is as follows:

Equal quantities of the patient's serum, an emulsion of tubercle bacilli, and white blood corpuscles (washed in one-half per cent. sodium citrate in normal salt solution) are mixed in a capillary pipette, and incubated at 37° C. for twenty minutes, after which blood films are

made of the mixture, and stained for tubercle bacilli. The average number of tubercle bacilli ingested by each polymorphonuclear white corpuscle is calculated, and the figure thus obtained is called the phagocytic index. The opsonic index is the result obtained by dividing the number of bacteria taken up per leucocyte in the presence of any given serum by the number taken up per leucocyte in the presence of the serum of a normal individual, which latter is regarded as unity. For example, the number of tubercle bacilli per leucocyte in the presence of a given serum = 3.

Tubercle bacilli per leucocyte in the presence of a healthy serum = 2.

$$2 : 3 :: 1 = \text{opsonic index} = 1.5.$$

The difficulties which we experienced in the Saranac Laboratory in using this tuberculo-opsonic test of Wright were considerable. We therefore propose to give the various steps in detail, together with modifications which we have tried.

Method of Obtaining Washed Leucocytes

It was found by Wright and Douglas that the source of the white corpuscles used made no difference in the result; in fact they can be taken from the patient or from some healthy person. An inferior position is therefore assigned to the source of the polynuclear white cells in the work of phagocytosis as compared with the serum.

To obtain the blood we make a prick in the side of a finger with a needle, wind a piece of string round the finger from above downwards in order to render it turgid. As the blood emerges from the prick, we draw it into a pipette containing a small amount of 0.5 per cent. citrate of soda solution in .85 per cent. NaCl. A ten c.c. pipette, with a bulb and a short stem drawn to a fine point, allows thorough mixing of the blood and citrate solution. The citrate solution prevents the blood from clotting. After each large drop of blood is drawn into the pipette, we draw up a little more citrate solution and shake gently. From six to ten large drops of blood are sufficient. This mixture of blood and citrate solution is then centrifugalized in narrow tubes, the supernatant solution drawn off, and then about the same quantity of .85 per cent. NaCl solution thoroughly mixed with the blood. This mixture is then centrifugalized, the supernatant solution drawn off, care being taken not to draw too close to the corpuscle sediment lest the layer of white cells be disturbed. This layer of white cells, called

"blood cream'" by Wright, is then carefully drawn off from the blood and thoroughly mixed. Formerly Professor Wright used four washings, the first with the citrate, and the remaining three with .85 NaCl. At present two washings are used, and we find it sufficient.

Method of Obtaining the Emulsion of Tubercle Bacilli for Phagocytosis

Considerable difficulty has been experienced by almost all who have used the tuberculo-opsonic test in obtaining a suitable emulsion of bacilli. This is due to the fact that the bacilli appear so frequently in clumps and not separated homogeneously.

At the very outset a two-fold technical difficulty confronted Wright and Douglas in preparing their emulsions. The first difficulty was associated with the fact that the tubercle bacillus occurs in ordinary cultures in agglomerated masses. The second difficulty is due to the fact that unaltered tubercle bacilli, when they have been obtained in homogeneous suspension, are aggluinated by the action of both serum and physiological salt solution. They overcame the first difficulty by breaking up the bacterial masses in a mortar in a 0.1 per cent. salt solution—*i. e.*, in a salt solution diluted up to the point at which it will no longer bring together by its agglutinating action tubercle bacilli, which have been mechanically separated. The second difficulty was overcome by heating the tubercle culture to 100° C.

In a private communication recently received from Dr. George W. Ross, an assistant of Professor Wright, the following directions were given to obtain an emulsion of tubercle bacilli such as they now use:

1. "If you use the glycerin suspension of tubercle bacilli (such as is left after making old tuberculin), you must first wash out the glycerin by means of water and filter paper—ending up the final washing with 1.5 per cent. solution of NaCl.

2. "Next transfer to a small agate mortar (one to one and a half inch in diameter) and rub up the washed tubercle bacilli to a paste; that is, use only a little of the 1.5 per cent. salt solution to begin with. Keep rubbing up, continually adding more salt solution until you have an emulsion which has the opalescence of thick ground glass.

3. "Centrifugate for some minutes to drive down the larger clumps.

4. "Pipette off the supernatant emulsion. As a rule this requires further diluting with the 1.5 per cent. salt solution. The extent of this is only learned by putting up trial tubes with serum and corpus-

cles. For example, if in the trial experiment the leucocytes contain clumps of, say, four or five bacteria each, you will know that further dilution and centrifugalization are necessary. Use always a 1.5 per cent. salt solution.

"From one to two tubercle bacilli per cell is a convenient average."

In our own work we have, however, used a different emulsion, prepared by Dr. E. R. Baldwin, who tried to improve the method by removing some of the wax from the bacilli, and thus to render them free from clumps. He did this by extraction with chloroform, as follows:

(*a*) A quantity of tubercle bacilli from broth cultures was washed until free from all traces of the culture medium. After drying these in the desiccator, one hundred and fifty grammes were pounded and rubbed to a fine powder in a mortar to break up the large clumps.

(*b*) This powder was then placed in a flask with chloroform. The flask was heated on a water bath with a return condenser. The emulsion was then filtered on hard filter paper. The residue was washed with hot chloroform, and afterwards evaporated by exposing the filter to air and then in the desiccator. This residue was again rubbed in a mortar and extracted again in the same manner.

(*c*) The washed residue was finally suspended in 185 c.c. cold chloroform and used as a stock emulsion.

To obtain a suspension from this stock emulsion our procedure is as follows:

Three-tenths c.c. of the chloroform emulsion is measured off and put into a small mortar; the chloroform is allowed to exaporate, which it does almost instantly, and the dry white powder that remains is rubbed up with one c.c. 0.1 per cent. NaCl. First it is rubbed in a small quantity of this salt solution, and then the remainder is slowly added. This emulsion is then transferred to a small centrifugating tube and centrifugalized for five minutes, at definite speed, to throw down the coarse clumps. A small quantity of the supernatant fluid is drawn off and thoroughly mixed. If one draws directly from the emulsion which remains in the centrifugating tube, when the test is made, one may draw from different layers and thus render the test inaccurate. The emulsion thus obtained is of very uniform density and free from clumps. The only objection is that some of the bacilli appear feebly stained. A further objection may be made that alterations are produced in the bacilli by the extraction with chloroform. Comparative

tests, however, with simply sterilized bacilli, have shown that the same relation may be expected in the phagocytic activity in each of them. Since the object of the test is to compare the opsonic strength of different serums, the particular form of the emulsion which gives the most accurate results is the only factor of importance.

(N. B. We now always follow Wright's method of preparing the emulsion, and find it satisfactory.)

Method of Obtaining the Serums

When an opsonic test is made we need some standard for comparison. At present the fresh mixed serums of several healthy persons are used as the standard serum by Professor Wright, and this mixed serum is regarded as unity.

The use of this standard is justified by the following facts:

1. The opsonic power is approximately the same in all healthy people.

2. The opsonic power of healthy people varies very slightly, or not at all, from day to day.

It is found that the opsonic power decreases gradually after the serum has been withdrawn from the body, and it is therefore necessary that the standard serum and the serum to be tested should be withdrawn within a few hours of the same time. Wright found that the opsonic power of the serum diminished but slightly up to twelve to eighteen hours, but that after it diminished considerably. In our work thus far we have used but one normal serum for a standard.

Method of Mixing and Incubating the Washed Leucocytes, the Serum, and the Emulsion of Tubercle Bacilli

Having obtained the washed leucocytes, the serum, and the emulsion, we then proceed to make the test:

The pipette into which they are drawn we make in the following way: A piece of glass tubing, about one-fourth of an inch in diameter and from four to five inches in length is heated over a flame and drawn out as fine as possible, and divided in the middle. The stem of this is about two inches in length, and the drawn out part about seven to eight inches. At a point about one to one and a half inches from the capillary end a mark is made with a blue or red pencil. This serves to measure the serum, emulsion, and corpuscles. By placing a closely fitting rubber nipple over the end of the stem, and by packing the stem for a short distance by two small layers of absorbent cotton, and

between these a small layer of some powder, such as plaster of Paris or chalk, it is an easy matter to draw up to the index, the serum, emulsion, and corpuscles, and to allow a small space of air between each of these. The tip of the pipette is wiped off after each operation.

The three are then expelled into a small tapering tube about one-eighth of an inch in diameter, one inch long, and closed at one end, and thoroughly mixed by drawing the liquid in and out. The mixture is then again drawn into the pipette, the end sealed in a flame, and placed in the incubator at 37° C. for twenty minutes. On removing the pipette from the incubator, the contents are again thoroughly mixed in another small tube, as described above, and slide smears are then made.

Method of Preparing Slides for the Reception of Blood Films

Professor Wright's method is as follows:

He says that the really important thing in connection with the slide is to be sure that its surface shall be rough. The polishing of the surface and the defective adherence between the blood and the slide which results from it furnish the opportunity for the piling up of the corpuscles one upon another, under the influence of the surface tension of the fluid. The polishing of the slide is, in other words, directly responsible for the patchiness of the ordinary blood film. He therefore finds it of benefit to boil all slides in strong caustic potash until their surface has become definitely hazy. This haziness depends upon inequalities of the surface, and it disappears when the surface oil or Canada balsam is placed upon the slide.

A still better method, also described by Wright, is to rub the surface of the slide with emery paper. He employs the finest variety of emery paper, and in order to obtain the necessary mechanical pressure mounts the emery paper by means of a rubber ring upon a stout cylindrical ruler.

(N. B. Our method is to use ordinary clean slides, and we find them very satisfactory. We keep them in 95 per cent. alcohol and dry before using.)

Method of Hardening and Staining the Slides

Professor Wright's present method is to fix the blood films in saturated corrosive sublimate, stain with boiling carbol-fuchsin, decolorize

with two per cent. sulphuric acid, and counterstain with methylene blue after washing in one to one thousand sodium carbonate.

Our method has been to fix with wood alcohol for several minutes, heat in the incubator at 37° C. for ten minutes in aniline-fuchsin, decolorize with one-half per cent. hydrochloric acid in fifty per cent. alcohol, and counterstain with Wright's stain. Wright's blood stain (James H. Wright) for counter-staining has proved superior in our hands to any other. We use it diluted with two parts of wood alcohol. The films are then dried and examined.

(N. B. Another method which we find satisfactory is to harden in 95 per cent. alcohol (ethyl), stain with boiling carbol fuchsin, and proceed as above.)

Number of Cells Necessary to Count

In the various published works by Professor Wright and his associates, it would appear that the count from a comparatively small number of leucocytes was thought sufficient for the determination of the opsonic index. We have paid special attention to this point in order to satisfy ourselves as to the usefulness of the test so far as tuberculosis is concerned. While it is true that the bacilli counted in twenty to thirty leucocytes may indicate in some cases the correct relation between a normal and tuberculous serum, when all the conditions are favorable as to serums and technique, we have found that an accurate count requires from one hundred to two hundred cells. Some examples showing the variations encountered are appended.

Up to the present time our work has been mainly confined to technique, and to testing the blood of patients who are taking tuberculin treatment. Our results are too few to give any definite conclusions, and we intend to give these at a later date.

The following counts of two hundred polynuclear cells show the variations in the groups of twenty-five, fifty, one hundred, and two hundred cells:

Experiment 30, March 27, 1906

K.'s washed corpuscles, 1 vol.
J. P.'s serum, 1 vol.
Suspension of tubercle bacilli, 1 vol.

1st	25 polynuclear cells	= 27 tbc.	= average of 1.08 tbc. per cell
2d	25 polynuclear cells	= 27 tbc.	= average of 1.08 tbc. per cell
3d	25 polynuclear cells	= 39 tbc.	= average of 1.56 tbc. per cell
4th	25 polynuclear cells	= 31 tbc.	= average of 1.24 tbc. per cell

5th 25 polynuclear cells = 24 tbc. = average of .96 tbc. per cell
6th 25 polynuclear cells = 30 tbc. = average of 1.2 tbc. per cell
7th 25 polynuclear cells = 24 tbc. = average of .96 tbc. per cell
8th 25 polynuclear cells = 45 tbc. = average of 1.8 tbc. per cell

1st 50 polynuclear cells = 54 tbc. = average of 1.08 tbc. per cell
2d 50 polynuclear cells = 70 tbc. = average of 1.4 tbc. per cell
3d 50 polynuclear cells = 54 tbc. = average of 1.08 tbc. per cell
4th 50 polynuclear cells = 69 tbc. = average of 1.38 tbc. per cell

1st 100 polynuclear cells =124 tbc. = average of 1.24 tbc. per cell
2d 100 polynuclear cells =123 tbc. = average of 1.23 tbc. per cell

1st 200 polynuclear cells =247 tbc. = average of 1.23 tbc. per cell

Experiment 30, March 27, 1906

K.'s washed corpuscles, 1 vol.
D. C. T.'s serum, 1 vol.
Suspension of tubercle bacilli, 1 vol.

1st 25 polynuclear cells = 22 tbc. = average of .88 tbc. per cell
2d 25 polynuclear cells = 27 tbc. = average of 1.08 tbc. per cell
3d 25 polynuclear cells = 26 tbc. = average of 1.04 tbc. per cell
4th 25 polynuclear cells = 27 tbc. = average of 1.08 tbc. per cell
5th 25 polynuclear cells = 21 tbc. = average of .84 tbc. per cell
6th 25 polynuclear cells = 38 tbc. = average of 1.52 tbc. per cell
7th 25 polynuclear cells = 38 tbc. = average of 1.52 tbc. per cell
8th 25 polynuclear cells = 33 tbc. = average of 1.32 tbc. per cell

1st 50 polynuclear cells = 49 tbc. = average of .98 tbc. per cell
2d 50 polynuclear cells = 53 tbc. = average of 1.06 tbc. per cell
3d 50 polynuclear cells = 59 tbc. = average of 1.18 tbc. per cell
4th 50 polynuclear cells = 71 tbc. = average of 1.42 tbc. per cell

1st 100 polynuclear cells = 102 tbc. = average of 1.02 tbc. per cell
2d 100 polynuclear cells = 130 tbc. = average of 1.30 tbc. per cell

1st 200 polynuclear cells = 232 tbc. = average of 1.16 tbc. per cell

Experiment 32, March 29, 1906

K.'s W. B. C., 1 vol.
J. P.'s serum, 1 vol.
Suspension of tubercle bacilli, 1 vol.

1st 25 polynuclear cells = 34 tbc. = average of 1.36 tbc. per cell
2d 25 polynuclear cells = 31 tbc. = average of 1.24 tbc. per cell
3d 25 polynuclear cells = 34 tbc. = average of 1.36 tbc. per cell
4th 25 polynuclear cells = 49 tbc. = average of 1.96 tbc. per cell
5th 25 polynuclear cells = 39 tbc. = average of 1.56 tbc. per cell
6th 25 polynuclear cells = 31 tbc. = average of 1.24 tbc. per cell
7th 25 polynuclear cells = 41 tbc. = average of 1.64 tbc. per cell
8th 25 polynuclear cells = 22 tbc. = average of .88 tbc. per cell

1st 50 polynuclear cells = 65 tbc. = average of 1.3 tbc. per cell
2d 50 polynuclear cells = 83 tbc. = average of 1.66 tbc. per cell
3d 50 polynuclear cells = 70 tbc. = average of 1.4 tbc. per cell
4th 50 polynuclear cells = 63 tbc. = average of 1.26 tbc. per cell

1st 100 polynuclear cells = 148 tbc. = average of 1.48 tbc. per cell
2d 100 polynuclear cells = 133 tbc. = average of 1.33 tbc. per cell

1st 200 polynuclear cells = 281 tbc. = average of 1.4 tbc. per cell

EXPERIMENT 32, MARCH 29, 1906

K.'s W. B. C., 1 vol.
T.'s serum, 1 vol.
Suspension of tubercle bacilli, 1 vol.

1st 25 polynuclear cells = 53 tbc. = average of 2.12 tbc. per cell
2d 25 polynuclear cells = 51 tbc. = average of 2.04 tbc. per cell
3d 25 polynuclear cells = 45 tbc. = average of 1.8 tbc. per cell
4th 25 polynuclear cells = 56 tbc. = average of 2.24 tbc. per cell
5th 25 polynuclear cells = 27 tbc. = average of 1.08 tbc. per cell
6th 25 polynuclear cells = 49 tbc. = average of 1.96 tbc. per cell
7th 25 polynuclear cells = 38 tbc. = average of 1.52 tbc. per cell
8th 25 polynuclear cells = 27 tbc. = average of 1.08 tbc. per cell

1st 50 polynuclear cells = 104 tbc. = average of 2.08 tbc. per cell
2d 50 polynuclear cells = 101 tbc. = average of 2.02 tbc. per cell
3d 50 polynuclear cells = 76 tbc. = average of 1.52 tbc. per cell
4th 50 polynuclear cells = 65 tbc. = average of 1.3 tbc. per cell

1st 100 polynuclear cells = 205 tbc. = average of 2.05 tbc. per cell
2d 100 polynuclear cells = 141 tbc. = average of 1.41 tbc. per cell

1st 200 polynuclear cells = 346 tbc. = average of 1.73 tbc. per cell

EXPERIMENT 33, MARCH 30, 1906

T.'s W. B. C.
J. P.'s serum.
Suspension of tubercle bacilli.

1st 25 polynuclear cells = 113 tbc. = average of 4.52 tbc. per cell
2d 25 polynuclear cells = 97 tbc. = average of 3.88 tbc. per cell
3d 25 polynuclear cells = 88 tbc. = average of 3.52 tbc. per cell
4th 25 polynuclear cells = 109 tbc. = average of 4.36 tbc. per cell
5th 25 polynuclear cells = 98 tbc. = average of 3.92 tbc. per cell
6th 25 polynuclear cells = 115 tbc. = average of 4.6 tbc. per cell
7th 25 polynuclear cells = 115 tbc. = average of 4.6 tbc. per cell
8th 25 polynuclear cells = 114 tbc. = average of 4.56 tbc. per cell

1st 50 polynuclear cells = 210 tbc. = average of 4.2 tbc. per cell
2d 50 polynuclear cells = 197 tbc. = average of 3.94 tbc. per cell
3d 50 polynuclear cells = 213 tbc. = average of 4.26 tbc. per cell
4th 50 polynuclear cells = 229 tbc. = average of 4.58 tbc. per cell

1st 100 polynuclear cells = 407 tbc. = average of 4.07 tbc. per cell
2d 100 polynuclear cells = 442 tbc. = average of 4.42 tbc. per cell

1st 200 polynuclear cells = 849 tbc. = average of 4.24 tbc. per cell

EXPERIMENT 33, MARCH 30, 1906

T.'s W. B. C.
K.'s serum
Suspension of tubercle bacilli.

1st	25	polynuclear cells	= 100	tbc.	= average of 4	tbc. per cell
2d	25	polynuclear cells	= 103	tbc.	= average of 4.12	tbc. per cell
3d	25	polynuclear cells	= 58	tbc.	= average of 2.32	tbc. per cell
4th	25	polynuclear cells	= 77	tbc.	= average of 3.08	tbc. per cell
5th	25	polynuclear cells	= 115	tbc.	= average of 4.6	tbc. per cell
6th	25	polynuclear cells	= 81	tbc.	= average of 3.24	tbc. per cell
7th	25	polynuclear cells	= 84	tbc.	= average of 3.36	tbc. per cell
8th	25	polynuclear cells	= 96	tbc.	= average of 3.84	tbc. per cell
1st	50	polynuclear cells	= 203	tbc.	= average of 4.06	tbc. per cell
2d	50	polynuclear cells	= 135	tbc.	= average of 2.7	tbc. per cell
3d	50	polynuclear cells	= 196	tbc.	= average of 3.92	tbc. per cell
4th	50	polynuclear cells	= 180	tbc.	= average of 3.6	tbc. per cell
1st	100	polynuclear cells	= 338	tbc.	= average of 3.38	tbc. per cell
2d	100	polynuclear cells	= 376	tbc.	= average of 3.76	tbc. per cell
1st	200	polynuclear cells	= 714	tbc.	= average of 3.57	tbc. per cell

DISCUSSION ON PAPER BY DRS. KINGHORN AND TWICHELL

Dr. Karl von Ruck, Asheville: All the patients have been systematically examined in our institution during the past year, and while no results have been gained I have found a large percentage that failed to react to the agglutination test, although there were definite evidences of bacilli in the sputum.

Dr. S. A. Knopf, New York: When Dr. Arloing published his experiments for the first time he was kind enough to send me a reprint. With the coöperation of Dr. Park and Dr. Lambert I tried the agglutination test at Bellevue Hospital and my experience corresponds exactly with that of the reader of the paper. We came to the conclusion that the agglutination test in tuberculosis is practically valueless and, therefore, we must rely upon a careful physical diagnosis.

Dr. William H. Park, New York: I wish to state that those tests were roughly made and should be substantiated by more careful work.

Dr. Nathaniel Bowditch Potter, New York: I can vouch for what has been said so far as time and care are concerned. We have been interested in New York in making some investigations upon a series of different kinds of cases, a list of which I will show tomorrow. Four of us have worked together. In listening to what was said about technique, I thought I might tell you two or three things which occurred

in our experience. In the first place, in regard to using a pooled serum for normal, we tried to use a pool like Dr. Wright, but we gave it up and now use practically always sera from three or four normal persons. With our technique we found more variations than in the cases Dr. Wright has published.

Another point is this: We take a normal case first; then we run two, three or four sera to be investigated. We often make two pipettes of normals, running the sera through at different times. We find this advisable because counts are not as uniform as they should be. After estimating the different normal counts we strike an average. If the variations in the normal counts are marked, we make more counts or start again.

We used the chloroform emulsion to some extent, but did not compare it long enough with a heated emulsion.

My own feeling is that we alter the germs sufficiently by heating and I do not believe we should subject them to chemical processes; this is unnecessary. After a number of weeks of failure we managed to get a good culture and make a uniform emulsion.

In the manufacture of a leucocytic cream we drop blood into a test-tube with citrate solution and shake. The great difficulty has been that unless we used the cream promptly we were apt to get poor results; the leucocytes become swollen or broken up.

We tried to prepare the slides with emory paper, but we could not procure a fine enough grade. At all events we had to discard emory paper. We simply use slides cleansed with soap and water; after drying smearing becomes perfectly easy.

So far as the number of cells to be counted is concerned we have adopted this plan. We felt that 20 or 30 cells were not enough, although Dr. Wright claimed the contrary. So we count a series of 75 or 100 cells; if the counts are not uniform we count more; we may count 100 or more.

In conclusion I would say that the technique is difficult, and only by having one, two or three people helping you and working together, can you get good results with any degree of speed. To illustrate this point. There were three of us working together from 8.30 until 1 o'clock and we prepared a series of 70 slides. To count 70 slides requires a long time. One man can count three or four slides an hour. It certainly is slow work.

Dr. E. R. Baldwin, Saranac Lake: The question of technique is

under discussion today and not the principle involved. It seems to me, from Dr. Wright's publications, that unless we have a more reliable technique we cannot expect to get more reliable and accurate results, and possibly the principle would be lost in the search for it by imperfect methods. The sera are so different and the phagocytic power is influenced by so many factors that the range of error is great and deductions made from these results are premature.

The question of bacillary emulsions is an important one and I think that better results would have been obtained if we had obtained a better emulsion of the tubercle bacilli. The first experiments were made with the chloroform emulsion, but I think that can be improved upon and be made far more uniform.

Dr. Hugh M. Kinghorn, Saranac Lake: Dr. Twichell's serum is used as the standard serum. The tests are made in the morning. One of us makes the emulsion and the other makes the "leucocytic cream." The tests are made as soon as the emulsion and the washed leucocytes are prepared. Our present methods of preparing our emulsions is as follows: Several broth cultures of tubercle bacilli are taken and the bacilli are washed first with water and then with 0.1 per cent. NaCl. The bacilli are then sterilized in the autoclave and an emulsion made with them. Enough bacilli are sterilized to last a considerable time. To get a good emulsion we take several fair-sized platinum spadefuls of tubercle bacilli and grind for from ten to fifteen minutes in a small mortar, slowly adding the 1 per cent. NaCl till 1 c.c. is added. This is then centrifugated for five minutes and a small amount of the supernatant fluid drawn off and thoroughly mixed.

We have found it unnecessary to use emery paper in preparing our slides. It is very easy to have an even slide by using ordinary clean slides.

Our purpose is to discuss the technique of the opsonic test. The men in this county, however, should feel encouraged to know that it is not necessary to use the method of Wright. Dr. Trudeau will give the results of tuberculin treatment tomorrow, and will give his methods and explain how to avoid reactions. By using his methods tuberculin can frequently be given without producing any reactions whatever, or at most few and slight reactions. Patients are usually insensible to the fact that they have received a dose of tuberculin. He does this by starting with a small dose and by increasing it slowly and always with an interval of three or four days between each injection.

In this way he has clinically, though unconsciously, followed Wright's method. In our judgment it is unnecessary to employ Wright's method. Where you give three or four tuberculin injections a day, it is quite impossible to examine the patients' blood next day. We rely on the general rule that if the patients go along well, it is unnecessary to test for the opsonic index.

STUDIES ON IMMUNITY IN TUBERCULOSIS, III

Experiments with Leucocytes, Lymph Gland and Bone Marrow Extracts of Immunized Animals

By E. R. Baldwin, M.D., and J. Woods Price, M.D.
Saranac Lake, N. Y.

At the completion of our second series of observations on the immunity reactions in immunized hares,[1] it was concluded that the process was an intense leucocyte emigration for the purpose of phagocytosis and bacteriolysis of the bacilli. The significance and importance of the leucocytes, both polynuclear and lymphocytes, seemed unmistakable, and their appearance in such numbers, together with manifestly greater congestion of the areas in the lungs as compared with those of control animals, suggested a specific alteration in the leucocytes or the leucocyte-forming centers. Beside this was the probability of a change in the endothelia subjected to the immunizing inoculation which was given in the blood stream.

The anti-bodies in the serum, whatever their importance in combination with the cells, have not been recognized as sufficient alone to protect the animals.

It was natural, therefore, to inquire whether this protection resided in these various groups of cells. Moreover, it must be remembered that anti-bodies in the serum are derived from specifically-influenced cells and in our experiments the agglutinin was strongest at the height of the reaction period in the immunized animals.

Some years ago Manfredi and his pupils published experiments with lymph node extracts from tuberculous animals and claimed encouraging results. The details of their work have not been available to

[1] See Studies on Immunity, II, Dr. Joseph Nichols, Vol. I, *Trans. Nat. Assoc. for Study and Prevention of Tuberculosis.*

us, but it was stated that guinea-pigs could be partially protected by injections of the gland extract. Other attempts to immunize by the use of caseous lymph-node material were made by French experimenters but without success. The influence of lymphoid tissue in protecting animals against tuberculosis has, however, obtained renewed interest during the past year by the preliminary announcement of V. Behring[1] at the Paris Congress for Tuberculosis. He intimates rather vaguely that the cells of the lymphatic system have the power to neutralize or transform the tuberculosis toxin into an immunizing substance. In the recent work of Bartel and Neumann[2] they find evidence of a weakening of virulence due to contact of tubercle bacilli with lymph tissue, though not with dog's leucocytes.

Our own experiments have been quite superficial and tentative thus far, but we may present the methods and objects in our mind as of timely interest.

We have injected guinea-pigs with an extract of bone marrow and a lymph node emulsion obtained from a tuberculin-tested calf inoculated with virulent human tubercle bacilli. Leucocytes from an immunized cow were also employed in another series of guinea-pigs.

The calf above mentioned had been inoculated for the purpose of obtaining various immunized tissues. The plan was to subject the animal to an intravenous virulent inoculation from which, after recovery, one might expect a specific cell change, responsive to a re-inoculation or a tuberculin injection.

If in place of a re-inoculation with living bacilli the same reaction could be produced by the toxin and the organs removed at the time of greatest stimulation, we might hope to procure antagonistic substances from them.

The inoculation was in this case followed by fever for two weeks, indicating exceptional virulence in the human bacilli which was a recent culture from sputum. After forty days, however, the calf, having no longer any symptoms, was injected intravenously with .005 gm. of extracted, pulverized bacilli, prepared after the manner of the so-called "T. C." of v. Behring[3] (at least so far as we were able to do this from

[1] V. Behring, E., *Zeitsch. f. Tuberkulose*, Vol. 8, 1905, p. 16.
[2] Bartel & Neumann, *Cent. f. Bakt.* (orig.), 1906, Vol. 40, pp. 518, 723.
[3] Living bacilli were extracted successively with water, 10 per cent. sodium chloride, alcohol and ether after which they were pulverized. By this treatment they were, of course, sterilized. (Extraction with alcohol-free ether alone would be preferable for wax removal, if coagulation is to be avoided.)

the meagre description given). The animal was killed after ten hours, during the height of the reaction, and the lungs, lymph nodes of the bronchial and mediastinal system, and the thigh bones were aseptically removed. They were passed through a sterile meat cutter and preserved with toluol, except the bone marrow, which was triturated with normal salt solution, strained and preserved in like manner in the cold.

Control specimens from each tissue were inoculated into guinea-pigs and unfortunately resulted positively in all cases, thus complicating the experiments intended to be free from either living or dead bacilli. The bacilli were evidently very few and of slight virulence, as the course of the infection was very chronic in the pigs, and smears from the emulsions revealed only an occasional bacillus. Sections of a tracheal node showed a very few giant cells and bacilli; otherwise no signs of tubercle were found.

The leucocytes were obtained from a cow which had repeatedly received inoculations of weak-virulent human bacilli followed by transient fever reactions. In order to obtain the leucocytes in the stage of reaction when they might be presumed to secrete anti-bodies or absorb the toxin, we injected the animal intravenously with increasing doses of "T. C." before each bleeding, which was performed either six or twenty-four hours after the injection. The blood was received directly into an equal amount of one per cent. sodium citrate in normal salt solution to prevent coagulation; it was then centrifugated at once and the upper layer of leucocytes on the surface of the sediment removed by pipetting. They were afterward preserved aseptically on ice for a few days.

Two sets of twelve guinea-pigs received subcutaneous injections of the marrow extract and leucocytes respectively, both before and after inoculation in the marrow-treated animals.

The leucocytes were not injected after inoculation of the pigs because the cow was killed which supplied the fresh leucocytes. The presence of tubercle bacilli in the extracts of bone marrow, though extremely scarce and killed by toluol, made the experiment of less interest, and that with the lymph node emulsion was abandoned for this reason. As the results were negative so far as demonstrating an apparent protective or therapeutic influence, the details are of no value.

The leucocytes of the cow likewise failed to change the course of inoculation tuberculosis in guinea-pigs. They were injected in doses of 0.2 c.c. every third day for three weeks. The inoculation was

delayed three weeks after the last dose to permit the animals to recover weight lost under the injections.

Injections of a new lymph node emulsion derived from the immunized cow above mentioned were also tried, using very small quantities, .1 c.c. to .25 c.c. in seven-day intervals before and after inoculation. The animals showed no reactions, nor when killed forty-two days after infection could any differences be noted in the lesions as compared with the controls. The lymph node emulsion was free from bacilli either living or dead, so far as could be ascertained.

CLINICAL AND CLIMATOLOGICAL SECTION

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VINCENT Y. BOWDITCH, M.D.

Boston

Secretary

EDWIN A. LOCKE, M.D.

Boston

THE SCOPE AND AIM OF STATE SANATORIA FOR TUBERCULOSIS

By Vincent Y. Bowditch, M.D.

Boston, Mass.

During the past ten years, the civilized world has seen an astonishing change take place in the method of treating the disease which leads the mortality list in densely populated communities. Dr. Bodington, of England, over half a century ago, was one of first if not the first to advocate the treatment of tuberculosis by fresh air in properly regulated sanatoria; but it is apparently authentic that before he could substantiate his opinions the poor man ended his days in an insane asylum. Whether he was placed there by friends on account of his advanced theories, which doubtless at that period were regarded as symptomatic of madness, or whether for genuine reasons, is thought by some to be a matter of doubt. It remained for Herman Brehmer, not many years afterwards, however, in the mountains of Silesia, to prove that consumption could be cured, and although ridiculed at first by his own profession, he had the happiness of living to see his ideas well-established in his own country, and finally take root and grow in other lands.

For years his followers abroad and in this country patiently carried out his ideas, finally convincing the skeptical that the new methods were holding out hopes of recovery to many who would have been in former years thought by most observers to be in the grasp of a hopeless disease. To Trudeau is the credit rightly given of having been the first one in America to give practical proof of what can be done to lessen the ravages of consumption when, not long after Brehmer, he began his noble work in the Adirondack Mountains. Gradually theories became facts, and the so-called "fresh air" treatment began to be zealously adopted. This was a farther development of the ideas taught by Brehmer, and was chiefly the insistence of the necessity of abso-

lutely fresh air for every moment of the twenty-four hours while the patient was under treatment. In later years it came to be shown that the same method could be successfully used not far from home; that surprising results could be obtained in a large percentage of cases at comparatively low altitudes and in what were formerly thought to be climates unfavorable for cure. Facing the popular cry that it was simply a "fad" that would sooner or later die down and disappear to be placed with the forgotten histories of many a so-called "cure" for consumption, this modern method has not only lived down this prejudice but has given sufficient proof of its efficacy in large numbers of sufferers who under other conditions would have doubtless succumbed to the disease.

Within the last decade these ideas have taken a sudden and surprising hold upon the community, and have spread like a prairie fire in every direction throughout the country. Fortunately the simile holds in the rapidity of its growth only, for its effects are beneficial not disastrous. With this rapidity of growth, however, come its attendant dangers from haste and ill-judged zeal. Those who have been preaching for years the doctrine of sanatorium treatment in properly selected cases, are obliged now to take a conservative position in order to counteract the extravagant statements of enthusiasts who, with too little knowledge, do harm to the cause by claiming too much. We have as yet no *panacea* for the treatment of consumption, although we are justified in the hope that we are on the eve of still greater advances than heretofore in this direction. We must remember, moreover, that no sane advocate of modern methods will ever claim that they are suitable for all classes of disease. Fresh air treatment pushed to an extreme with often marvellous results in cases where the vitality can still resist the rigors of a northern winter, would be foolish and cruel for the far-advanced cases or in old people in whom vitality is low. Experience and judgment must be used in this as in every branch of medical or surgical science, otherwise disaster ensues. Disappointment, reaction of feeling and condemnation follow quickly, and with them the pendulum swings far in the other direction, and great harm comes to a cause that when judiciously advocated can be of untold good to the human race. In this connection the indiscriminate and hasty use of the word "cure" must be strongly condemned, for it only brings harm to the patient through the probability of relapse from disregard of watchfulness and care necessary for months after cessation of active

symptoms. To others also it is apt to bring discouragement and distrust of methods which, fully understood, can with time and patience bring about lasting results.

Many thoughts and suggestions come to me as we touch upon these matters, but it would be impossible within the scope of this paper to do more than suggest those which from experience I have learned to believe are most vital. With an experience of over seven years as attending physician to the large State Sanatorium at Rutland, Mass., from its incipiency up to a comparatively recent date, and recognizing the rapidly growing tendency of other states to follow the example of Massachusetts, I believe it will be well at this meeting of physicians and laymen to briefly give one or two words of caution to those who are urging the erection of similar institutions elsewhere. It is my firm conviction, which I have always held, that sanatoria, in the strict sense of the word, should be built away from the neighborhood of cities and kept solely for the use of incipient cases or for those in whom the disease has not so far progressed as to preclude a life of usefulness again. Far-advanced cases should not be sent to such institutions, but for them hospitals of different construction should be made within easy access of large cities and towns to enable friends and relatives to visit the patients without entailing much loss of time or expense.

It is of vital importance, moreover, if the best and most lasting results are to be obtained, that sanatoria intended for patients who are still in vigorous bodily condition should not be so large as to render personal supervision almost an impossibility. In the watchful care necessary for each individual at a critical stage of the disease, when ignorance may be the cause of fatal errors in mode of life, lies the great virtue of this method of treating tuberculosis. Just so surely as we increase the proportion of patients to the number of medical assistants beyond certain limits, just so surely do we diminish the chances of proper supervision of individuals and thereby run great risk of not gaining favorable results for those under our care.

One fact I believe now to be of great importance if we would keep public sanatoria for the tuberculous above the level of mere boarding-houses with medical attendants. I have already alluded to the extraordinary interest awakened throughout the world in the last decade by the favorable results of fresh air treatment. This is a great step in advance and of great educational value; but we should now keep something higher before us lest we stagnate and merely content our-

selves with watching a large percentage of patients leave our sanatoria with the disease in a state of arrest, ready to act as missionaries in the world to teach others the simple but essential laws of hygiene. We should aim now to make our state sanatoria centers of scientific research, where clinical observation can go hand in hand with laboratory investigation. That this is no Utopian scheme for public institutions, is well illustrated in the Boston City Hospital, which, although under municipal control alone, not merely offers practical aid to thousands of sufferers from acute disease but has built up slowly a pathological and bacteriological department which is an honor to Boston, and the fame of which is now established in America and Europe.

With a great clinic like that now at Rutland there is an almost unrivalled opportunity for not only giving immediate aid to hundreds of sufferers from tuberculosis, but for establishing by comparatively simple means the nucleus for laboratory research which shall have for its special object the study of methods for stamping out tuberculosis, or at least of so keeping it under control that the awful mortality from this disease may be reduced to a minimum.

In order to place our state sanatoria upon such a basis, it is essential that those in control should be men and women of broad vision and that the policy of such institutions should be left to those whose special training fits them to be guides for scientific as well as practical work.

With the example before us of what Trudeau has accomplished in the study of tuberculosis in his laboratory at Saranac Lake, and with the great hope ahead of us that the disease may yet be conquered, I can conceive of no more inspiring ideal for state institutions, nor anything in which our individual communities could take greater pride than to make such an ideal a reality. That this can be done I firmly believe. It only remains for others who have similar beliefs to use their influence to this end, and we may yet live to see our wishes accomplished.

REPORT OF THE COMMITTEE ON CLINICAL NOMENCLATURE

Dr. Vincent Y. Bowditch, Boston, *Chairman*
Dr. W. H. Bergtold, Denver
Dr. Lawrason Brown, Saranac Lake
Dr. Herbert Maxon King, Liberty
Dr. Geo. W. Norris, Philadelphia
Dr. Jno. H. Pryor, Buffalo

During the past two or three months the committee has endeavored to learn the opinions of those who are in charge of sanatoria throughout the United States, upon the merits or otherwise of the plan suggested by the committee at the last meeting of the National Association in May, 1905. Through the efforts of Dr. King who sent printed circulars with questions to one hundred and eleven sanatoria, we have received replies from forty-seven, including most of those which are well known throughout the United States. One of these has since been discontinued and one had not been under way a sufficient length of time to warrant an opinion, therefore only forty-five answers were considered.

On the whole, the replies are, in the opinion of the committee satisfactory as far as justification of further trial of the nomenclature plan is concerned. The few criticisms which have been made are such as had been thoroughly discussed by the committee before the plan was originally presented. While recognizing the force of some of these criticisms, the committee has deemed it wisest for the present to make no radical change from the fact that in any such arrangement it would be absolutely impossible to meet the requirements and objections of each individual, and concessions must of necessity be made by every one in order to approach any sort of uniformity of nomenclature. Even an imperfect plan is better than the previously existing chaos.

Out of the forty-five whose replies are considered all but seven expressed the intention of keeping on with the plan as it now stands. Among the seven who do not intend to do so, five receive far-advanced

cases, which fact renders the use of any such plan futile, one intends to "consider the matter" and one now makes use of the so-called "Turban-Spengler method" and declines to change. The committee desires naturally full and frank criticism of the plan from those whose experience with large numbers of patients justifies their opinion. At the same time they feel that the period of a few months is not enough to give the plan a thorough trial and they would strongly urge the Association to adopt the same method with one or two very slight changes for another year, at the end of which time a more just estimate can be made of the present scheme.

REPORT OF THE COMMITTEE ON CLINICAL NOMENCLATURE[1]

THE appended report is made by the Committee on Nomenclature appointed by the President of the National Association, after long-continued discussion and earnest endeavor to decide upon a scheme which shall be of practical use in tabulating cases of pulmonary tuberculosis and in making comparisons of the results of residence in different parts of the United States.

The International Association in Europe has already adopted the plan suggested by Turban and in order as far as possible to make uniformity of records Turban's plan forms the basis of our own. As the former did not appear to be quite comprehensive enough to satisfy our needs, the committee has made some modifications of and additions to the original plan.

The great difficulty of presenting any report which will be satisfactory to all will be recognized at once. It should be stated moreover that the one presented has been formed only by mutual concession and after full discussion on the part of every member of the committee.

The plan of dividing the cases into classes of "incipient," "moderately advanced," etc., is suggested to supplement the divisions I, II, and III made by Turban which are anatomical only and do not seem quite comprehensive enough in character.

In presenting the scheme to the Association for approval or otherwise the committee recognized the fact that it is necessarily not perfect, but believes it can be used as a working basis and that time alone will show whether further modifications are advisable or not.

TRANSLATION WITH SOME MODIFICATIONS OF TURBAN'S SCHEME FOR A METHOD OF COMPARATIVE STATISTICS FOR PULMONARY TUBERCULOSIS

[1] With changes suggested by Committee for the next year.

From *Tuberculosis*, monthly publication of the Central International Bureau for the Prevention of Consumption. September, 1904. Johann Ambrosius Barth, Leipzig.

Suggested for use in the National Association, with the addition of the scheme offered by the Committee.

1. Extent of disease in lungs:	I. II. III.	For exact definition see below.
2. How long consumptive?	3 months	Period to date from the observation of the first clinical symptoms e.g., stubborn coughing, hæmoptysis, pleurisy, loss of flesh, etc.
3. General condition of the patient:	A X	A = favorable. X = unfavorable.
4. Digestion:	B Y	B = unimpaired. Y = impaired.
5. Pulse:		The pulse is to be registered every morning and evening, the patient resting.
6. Temperature:	F f	F = Maxima for the day of 101° F. f = Maxima for the day from 99° F. to 101° F.
	t n	t n = normal temperature (mouth).
7. Tubercle bacilli:	+ O	+ = tubercle bacilli present. O = tubercle bacilli absent.
8. Tuberculous complications:	Larynx	Name of the organ suffering from tuberculosis.
9. Other complications:	—	Name of the disease.
10. Result of treatment:	—	*Vide* Classification of Results of Treatment proposed by Committee on Nomenclature.

Definition of the Extent of Disease in Lungs, According to Turban:

"I. Slight lesion extending at most to the volume of one lobe or two half lobes.

"II. Slight lesion extending further than I., but at most to the volume of two lobes; or severe lesion extending at most to the volume of one lobe.

"III. All lesions which in extent of the parts affected exceed II.

"By 'slight lesion' we understand disseminated centres of disease which manifest themselves physically by slight dullness, by harsh, feeble, or broncho-vesicular breathing, and by râles.

"By 'severe lesion' we mean cases of consolidation and excavation such as betray themselves by marked dullness, by tympanitic sounds, by very feeble broncho-vesicular, bronchial, or amphoric breathing, by râles of various kinds.

"Purely pleuritic dullness, unless marked, is to be left out of account; if it is serious, the pleurisy must be specially mentioned under the head of 'tuberculous complications.'

"The volume of a single lobe is always regarded as equivalent to the volume of two half lobes etc."

By the Committee

Proposed Classification of Cases and Results of Treatment in Pulmonary Tuberculosis to be Used in Connection with Turban's Scheme

Progressive: (Unimproved.) All essential symptoms and signs unabated or increased.

CLINICAL SECTION

Improved: Constitutional symptoms lessened or entirely absent; physical signs improved or unchanged; cough and expectoration with bacilli usually present.

Arrested: Absence of all constitutional symptoms; expectoration and bacilli may or may not be present; physical signs stationary or retrogressive; the foregoing conditions to have existed for at least *two* months.[1]

Apparently Cured: All constitutional symptoms and expectoration with bacilli absent for a period of *three* months; the physical signs to be those of a healed lesion.

Cured: All constitutional symptoms and expectoration with bacilli absent for a period of two years under ordinary conditions of life.

To be used in connection with Turban's scheme of dividing the stages of disease into I, II and III.

Incipient (Favorable)

Slight initial lesion in the form of infiltration limited to the apex or a small part of one lobe.
No tuberculous complications. Slight or no constitutional symptoms (particularly including gastric or intestinal disturbances or rapid loss of weight).
Slight or no elevation of temperature or acceleration of pulse at any time during the twenty-four hours, especially after rest.
Expectoration usually small in amount or absent.
Tubercle bacilli may be present or absent.

Moderately Advanced

No marked impairment of function either local or constitutional.
Localized consolidation moderate in extent with little or no evidence of destruction of tissue;
Or disseminated fibroid deposits.
No serious complications (tuberculous).

Far Advanced

Marked impairment of function, local and constitutional.
Localized consolidation intense;
Or disseminated areas of softening;
Or serious complications (tuberculous).

Acute Miliary Tuberculosis

[1] The length of time mentioned is of course somewhat arbitrary, but is intended to cover the cases which frequently occur, where the patients leave a sanatorium for various reasons, contrary to advice, after a stay of a few weeks, although all active symptoms may have ceased completely soon after entrance.

PLAN SUGGESTED BY THE COMMITTEE ON NOMENCLATURE FOR TABULATION OF CASES FOLLOWING TURBAN'S SCHEME IN CONJUNCTION WITH COMMITTEE'S SCHEME.

Name.		Condition.	Involvement.		Duration of Disease.	General Condition.	Digestion.	Range of Pulse.	Max. Temp. for Day.	T. B.[1]	Complications.	
			Amt.	Side.							Non-tub.	Tub.
Mr. X.	On Admission.	"Moderately" Advanced.	II.	R. or L.	3 mos.	Favorable.	Impaired.	76–100	100°	+	neg.	neg.
	At Discharge.	Arrested.	II.	R. or L.	9 mos.	Favorable.	Unimpaired.	76	98.6°	0		

[1] Absence or presence of tubercle bacilli to be determined only after repeated examinations while patient is under observation.

THE THERAPEUTIC USE OF TUBERCULIN COMBINED WITH SANATORIUM TREATMENT OF TUBERCULOSIS

By E. L. Trudeau, M.D.

Saranac Lake, N. Y.

The wild enthusiasm which greeted Koch's announcement in 1890 of his discovery of tuberculin, and his claims for its diagnostic and therapeutic possibilities, was, as you know, very soon followed by bitter denunciations of the proposed method of treatment, and even of the distinguished scientist himself. Tuberculin was soon abandoned, and for a long time was considered as so dangerous that its use was looked upon as akin to malpractice. A few physicians, however, both here and abroad, continued the study of its careful application to cases of pulmonary tuberculosis, and of late more frequent publications on this subject point to renewed interest in the employment of some sort of vaccine as an immunizing agent in this disease.

So general and bitter was the condemnation of tuberculin that between 1891 and 1900 it was with the utmost difficulty that I could persuade a few patients at the Sanitarium each year to take the treatment while in the institution. As I have, however, used tuberculin injections continuously, though at times in a limited number of cases only, at the Sanitarium ever since 1890, I have thought that a summary of the impressions I have gained from my experience might prove of interest. Dr. Lawrason Brown has already published a detailed report of the cases treated at the Sanitarium up to 1903. I will not attempt to review the extensive literature of the subject, to discuss lengthy statistics bearing on the comparative results, or to go into detailed history of cases, but merely confine myself, as far as possible, to my own experiences, and briefly state my impressions of this method of treatment.

As a diagnostic agent the tuberculin test has been used at the Sani-

tarium occasionally for the past fifteen years. So far as its danger is concerned, my observation has been that when given according to the well recognized rules which alone make its administration justifiable, I have never known any ill effects follow the test beyond occasionally a somewhat severe or prolonged reaction, except possibly in three cases, which were somewhat unpleasant experiences. One occurred in the practice of another physician, and two were at the Sanitarium. In the first case there was constitutional impairment, without any marked physical signs, and a test injection of old tuberculin resulted in a moderate reaction, which subsided but was soon followed by an aggravation of all the symptoms, and I believe the case ultimately did badly. The other two cases were at the Sanitarium. A slight hemorrhage followed the first reaction in one case two weeks after its subsidence, but there was no other ill effect. In the other, after four days of normal temperature following the first reaction, blood spitting occurred, and an exacerbation of all the symptoms, with marked fever, followed and continued for some time. Whether these occurrences were merely coincidences, or were due directly or indirectly to the tuberculin it is difficult to be certain of.

Picket, who recently injected 929 patients, in order to confirm a diagnosis of pulmonary tuberculosis where the bacillus was absent, saw quite prolonged disturbance of the patient's condition follow in three cases, while in twenty the reactions were " more violent than desirable." At the Sanitarium the test has been of great value in helping to reach a conclusion as to the absence or presence of tuberculosis, especially in closed tuberculosis, or where the tuberculous nature of a pulmonary lesion was in doubt; a conclusion which, in the great majority of cases, has proved to be the correct one, and of inestimable value to the patient.

The tuberculin test should never be resorted to until the physician has failed to reach a conclusion after a careful application of the clinical methods of diagnosis, and as our skill in the detection of closed tuberculosis increases, it may be necessary to use the test only in exceptional cases, as the reactions at best are sometimes an unpleasant experience for the patient. On the other hand, the more we realize how really curable closed tuberculosis is, the more valuable becomes a method which reveals its presence when all other clinical means fail.

I have persisted in the study of tuberculin treatment at the Sanitarium, not on account of any immediate brilliant results noticed in its application, although I saw enough of its effects to encourage me to

persevere in its use; but principally, in spite of the popular clamor against it, because it is based on a certain degree of success demonstrable in animals by the experimental method, and because the production of artificial immunity by the specific poison of a disease is the line along which success has already been attained, and is being attained, in other infectious diseases.

The experimental evidence on which tuberculin treatment is based is not as complete or satisfactory as one would wish. Koch gave no details of the method by which he attempted to immunize and cure guinea-pigs with old tuberculin, T. R., or Bacillen Emulsion, but merely states that they can be rendered resistant to subsequent inoculations, and that when treated by these products, their lesions show marked evidence of fibrosis. His associates published details of experiments, but the results, although encouraging, did not show complete cure or immunity. Other observers have reported a varying degree of success in the immunization of small animals, and in their treatment by bacillary products. Broden,[1] perhaps, gives one of the most detailed descriptions of the good results which he obtained on dogs injected with the filtrate of liquid culture, both before and after intraperitoneal inoculation, and demonstrates the curative influence of tuberculin as shown by a comparative microscopical study of the lesions of the treated and untreated animals, as well as by the survival of the former and the death of the latter. Pathological observations bearing on the microscopic appearances of the lesions of patients who have been treated successfully with tuberculin, and have died of other causes, would be of great value at present.

The most convincing evidence of the favorable results of tuberculin my own experimental work has shown me, I obtained and published as early as 1892. By treating tuberculous iritis in the rabbit's eye by subcutaneous injections of the unheated filtrate of bouillon cultures of the tubercle bacillus, a retrogression of the lesion and an apparent healing gradually took place, which, however, ultimately relapsed somewhat, though very slowly. Guinea-pigs and rabbits previously injected with dead tubercle bacilli, I have found, live on an average somewhat longer than control animals when subsequently inoculated. The beneficial influence of treatment of small animals with various products of the tubercle bacillus, however, are demonstrated, not by the cure of a progressive generalized tuberculosis in them, for this does not occur;

[1] Recherches sur l'histogenese du Tubercle l'action curative de la Tuberculine. *Archiv. de Medicin Experimentale,* January, 1899.

but by the evident tendency to healing shown in localized tuberculosis, and in the more chronic course of the disease in the treated than in the untreated animals.

The immunity obtained by non-living products of the tubercle bacillus, however, is slight and only relative, and is not to be compared to that which I have been able to produce by preventive inoculations of living attenuated cultures. Behring's experiments of cattle immunization thus far published show the same thing; namely, that he obtained no solid immunity in cows with various *non-living* tuberculous products, but that he achieved success and produced a solid immunity by previous inoculations of *living* human cultures, and all these experiments establish for tuberculosis, by unquestionable evidence, the principle of artificial immunization, hitherto looked upon as impossible of achievement.

Animal experiments, therefore, on which tuberculin treatment in man is based, show that tuberculin immunity is not identical with immunity to tuberculosis, for it does not protect animals absolutely against inoculation tuberculosis, nor materially retard the course of generalized tuberculosis. It would seem that contact between the living bacillus, or the product of the living bacillus, and the cell, is necessary to the production of a solid and lasting immunity, for up to the present this, for tuberculosis or for other bacterial diseases, has been accomplished in animals only by protective inoculations of a *living* germ. Behring, however, in his recent announcement claims to have discovered a successful method of immunization for cattle without the use of liying bacilli.

Nevertheless, tuberculin immunization, even in the most susceptible animals, undoubtedly prolongs life somewhat, retards the development of the disease in its earlier stages, and produces changes in the lesions which demonstrate an attempt at healing, which, in localized tuberculosis, may be equivalent to a more or less complete cure. The limitations of tuberculin in the treatment of experimental tuberculosis in animals should therefore be borne in mind in judging the results of tuberculin treatment in human beings. Why should we expect it to do more for man than it can accomplish in animals?

To what extent, if any, does tuberculin immunization induced in man favorably influence the course of human tuberculosis? From the renewed interest in this form of treatment it would seem that the claims of this method are soon to be thoroughly and dispassionately settled.

Most of the proposed tuberculins have been tested at the Sanitarium. The first used was Koch's original tuberculin. Later, after the publication of Hunter's work in 1891, I made his Modification B myself, from the filtrate of liquid culture. The albumoses contained in the unheated culture medium, having been precipitated with ammonium sulphate, were taken up in distilled water and dialyzed, Hunter claiming more local and less general reaction from this product. This preparation was used at the Sanitarium for a time. In 1896, Buchner's Tuberculo-plasmin, and 1900, Landmann's Tuberculol, were both tried, as well as Koch's T. R., and since 1901 Koch's Bacillen Emulsion has been principally used; but Koch's three tuberculins have been most generally employed.

The effect of these preparations produced symptoms which were nearly identical, and are the well known ones of tuberculin reaction. It has been impossible to reach any conclusion as to the relative therapeutic value of these different preparations. Koch's T. R. and Bacillen Emulsion seem to be more uncertain in their action, and to produce more frequently strong and unexpected reactions, and this is a serious objection to their use, as occasionally unexpected and pronounced reactions occur, even if the dose is increased with the utmost caution. The reason for this undoubtedly, to a great extent at least, lies in the fact that they are mostly emulsions and not solutions; that absorption of such a suspension is much more difficult and uncertain than that of a readily soluble toxin; and that unless great care is exercised in thoroughly shaking the bottles and in drawing from the centre of the liquid rather than the top or bottom, the dilutions made will contain very varying amounts of the suspended but undissolved bacterial substance.

Reasoning from analogy and from what we know of artificial immunization in other bacterial diseases, tuberculins in the preparation of which no heat has been applied are likely to be the most efficient. Koch's bacillen emulsion, and the filtrate of ripe cultures as used by Denys, meet this requirement. The first contains all the toxins and endotoxins to be found in the bodies of crushed tubercle bacilli; the second, the toxins and any other substances which may be produced by the growth of the bacilli, or dissolved from their disintegrating bodies in a liquid medium, and both are entirely unaltered by heat.[1]

It is possible that the chemical researches of de Schweinitz, Levene,

[1] Dr. Theobald Smith, as a result of his recent studies on animals, suggests virulent uncrushed tubercle bacilli, killed by moderate heat, as the best vaccine to be tried in attempts at immunizing human beings.

Behring, Ruppel, and others, exhaustive as they have been, may be carried still further, and that organic chemistry may yet produce a more efficient tuberculin by the elimination of certain substances which are injurious, and the retention of others which are immunizing; but Koch's long and careful work in this direction is suggestive, for after prolonged investigations which resulted in his T. R. tuberculin, he has more recently put forth his Bacillen Emulsion, which is merely a suspension of crushed tubercle bacilli, and contains entire and unaltered all the toxins contained in the bodies of the bacilli. Behring's announcement, on the other hand, is full of encouragement. His T. C. is a toxin which differs from Koch's T. R. principally in its freedom from the waxy elements contained in the bodies of the bacilli, and it is possible it may prove to be a more efficient tuberculin than any we now possess. From what we may infer from Behring's guarded and enigmatical utterance, he has gone even farther, and it would seem that he has succeeded in transforming by contact with the living cell his T. C., which is a toxin, into his "Tuberculase," which is an immunizing and curative substance capable of immediate absorption by the cells of susceptible animals and man, and thus producing the desired immunity.

The cases selected for treatment have (with a few exceptions when soon after Koch's discovery, tuberculin was given as a last resort to far advanced patients who begged to be treated) belonged in the incipient and advanced class who were mostly apyretic, or whose temperature at irregular intervals only reached from 99.5 to 100, and whose general nutrition was good. The acute types, or those suffering from marked febrile remission or hectic fever were excluded. Patients running a continuous temperature, even if not above 100 Fh., with little to be heard in the lungs, but with rapid pulse, emaciation, debility, and cachexia, pointing to scattered miliary tuberculosis, were also excluded. Elsassar, Denys and others, advocate the use of tuberculin injections even in acute febrile cases, but I have had no experience with such cases.

For a long time the tendency was to choose as favorable cases as possible, from both the incipient and advanced classes, for treatment; but little by little less favorable ones were selected, and during later years those whose improvement seemed to be at a standstill and to have but little chance of arresting their disease by the hygienic and open-air method alone, have been more frequently treated. It cannot be denied, however, that the desire to select, from whatever class, patients whose

nutrition was good, prevailed to a greater or less extent, and must have somewhat influenced the results.

The first impression which the physician receives who begins to make use of tuberculin, is a most profound respect for the tremendous potency of this toxin. A toxic substance which, in so infinitesimal a dose as the 1/5,000 of a milligram of the solid substance contained in Koch's Bacillen Emulsion, may produce typical and marked constitutional disturbance in the tuberculous individual, is certainly not to be used heedlessly, and is potent for evil if carelessly administered. I would not urge any physician who prizes his peace of mind to embark on the treatment of tuberculosis by this method unless he is prepared to begin with minute doses, and increase with the utmost caution. He will also soon be made to feel the deep-rooted prejudice which exists, both in the profession and laity, against tuberculin treatment, and he must be prepared to meet criticism and blame for all the exacerbations and complications which naturally develop in the course of the disease, and which are invariably attributed not to the disease but to the treatment; while coincidences will occur occasionally which make his position indefensible, and which he must be prepared to face as best he can. I have had tuberculous meningitis, hemoptysis, and uncontrollable pyrexia, all ending fatally, occur in patients who were about to take tuberculin, but for some reason or other did not take it.

The method of administration is of the greatest importance, and has varied as time passed. At first little attempt was made to avoid reactions, which were advised by Koch, and which he still seems to consider as necessary to success in this form of immunization, for in his last paper on Bacillen Emulsion he says: "One increases the dose very rapidly in order to obtain very pronounced reactions, with elevations of temperatures of 1.5 to 2 C. As soon as a strong enough reaction is obtained, the intervals must be lengthened to from six to eight days or more."

From my own experience with tuberculin I have formed the impression not only that fever reactions are not necessary to obtain good results, but that although occasional moderate reactions are unavoidable and apparently do no harm, every effort should be made to avoid them. If frequent and violent, they have a bad effect on the patient's general condition, and are by no means free from danger, as was shown during the early history of tuberculin treatment, the danger being the production of continuous fever, cachexia, and increased activity in the disease.

If we abandon the view that fever reactions are necessary to obtain results, and look upon them as the result of over-stimulation; if we accept as a working theory that any curative influence of tuberculin is due not only to a local reaction of the lesion but also to a stimulation of the body cells by the injected toxins—a stimulation which results in the production of some sort of anti-body by these cells, as well as possibly an increased activity of the phagocytes—the best method of treatment would undoubtedly be to continue this stimulation by minute and very gradually increased doses for as long a period of time as possible. Whatever reactions unavoidably occur are only to be considered as indicating that the limit of the patient's capacity for responding, by the formation of antitoxic or antibacterial substances, to the stimulus of the injections has been exceeded.

We must divest our minds of the impression that because small doses produce no immediate apparent effect they are therefore ineffectual, for we have ample evidence to the contrary. A minute amount of tuberculin, which produces no rise of temperature when injected in rabbits with tuberculous iritis, nevertheless is capable of bringing about a very appreciable local reaction and leucocytosis. The same occurs in tuberculous nodes and lupus, and the work of Wright and Douglas proves that minute doses, and a very gradual increase, are met by a very appreciable and easily demonstrable response of the defensive resources of the living organism.

The best method has seemed to me to begin with very minute doses —a 10,000 or even 1/20,000 of a milligram of solid substance Koch's Bacillen Emulsion, or a 1/1,000 of a milligram of old tuberculin—and increase so gradually and at such intervals as to carry the patient to full doses with as little disturbance as possible; and by taking sufficient time, most patients can be taken through the entire treatment with but occasional and moderate reactions. At the slightest evidence of intolerance, as manifested not only by the patient's temperature, but by his symptoms, by marked irritation at the site of injection, or depreciation of his general condition, the interval between the injections should be lengthened and the dose diminished for a time. Care should be taken never to inject after a reaction until all effects of the previous reaction, both on the patient's temperature and general condition, have entirely passed away. I have also formed the impression that the treatment should be extended over as long a time as is needed to avoid reactions, no matter how long that may be, and that time is an important element

in obtaining the best results. Six months of treatment is almost always necessary, and a year or more would be better in many cases.

The patient, while taking the injections, should show no depression of general health, and should have, except it be for the 48 hours following an increase of dose, no fever above his usual temperature range; if this occurs the treatment should be discontinued, and only resumed when he has recovered his normal condition. If full doses, that is, 1 c.c. old tuberculin of 5 milligrams solid substance Bacillen Emulsion, can be reached without violent reactions and without depreciation of the general health (but not otherwise), the injections should continue until one full dose has been given; but the intervals should be lengthened gradually, as the higher doses are reached, and extended to two weeks between the last two or three injections. The physician must, of course, individualize, and be guided throughout the treatment, and in his judgment, as to the dosage to which it is to be carried, entirely by its effect on the patient; and on his watchfulness and skill will greatly depend the safety of the patient and the degree of success attained.

I quite agree with Denys that the principal faults in treatment—faults which may lead to failure, and even seriously endanger the patient's chance of recovery—are: Beginning the treatment with too large amounts; raising the dose too rapidly, or at too short intervals; injecting again before all effects of a reaction, both constitutional and local, have passed away; increasing the dose after a reaction has occurred; neglecting to consider malaise, headache, loss of appetite, and increased cough, as evidences that the limit of the patient's tolerance has been reached, and calls for an interval of rest and a reduction of the dose.

Also, that the physician who disregards, as of no importance, an increase of a minute fraction of a milligram of tuberculin, or a rise of a few tenths of a degree of temperature, will meet with disappointment and disaster in the application of tuberculin treatment. I have become convinced that any danger there may be of aggravating the patient's condition by tuberculin treatment lies principally, if not wholly, in its faulty or reckless administration.

Tuberculin immunity does not last indefinitely, and it may be well for the patient to take another course of treatment in four to six months if any symptoms should have reappeared, but with a very few exceptions the patients at the Sanitarium took but one course of injections.

The serum agglutination method, as proposed by Koch, has not been found reliable either as a guide to dosage or as an indication to the degree of immunization produced by tuberculin.

The most interesting work of Wright and Douglas on the production of opsonines in the blood, the presence of a positive and negative phase in artificial immunization, and finally the application of the opsonic index as an accurate guide in regulating the doses of vaccine and intervals between injections, is a brilliant contribution to our knowledge of the mechanism of artificial immunization, and a striking attempt at the practical application of exact laboratory methods to the treatment of disease. It is to be regretted, however, that even if the deductions Dr. Wright draws as to the necessity of being guided by the rise and fall of the opsonic index, and even if the accuracy of his method of determining it should be confirmed, the degree of skill required in carrying out such delicate technique and the time and work necessary in the determination of the opsonic index, make it generally unpractical of application to the treatment of disease in a large number of patients. Besides, as Elsassar remarks in regard to the agglutination method, the patients object to periodical phlebotomies; the reactions are quite enough for them.

The immediate results of tuberculin treatment are not very striking, and up to the time of discharge (generally six months) when patients, treated and untreated, who were classified alike on admission are compared, there is little difference to be noted in their condition, as the majority, specially in the incipient class, whether treated or not, show more or less marked improvement in symptoms and general condition. It is rather when studying the effect of the injections on cases somewhat more advanced in the disease that one notes occasionally unusually rapid and unexpected improvement, and that the preponderance of improvement seems to be in favor of the patients who have taken tuberculin.

The physical signs in tuberculin-treated cases may appear to grow worse, and rales develop where they were not heard at first, while the expectoration increases, but if no strong reactions have occurred this is not marked, and everything in the chest soon returns to its usual condition and the expectoration lessens if the doses are not pushed too rapidly. Even the disappearance of bacilli is often not much more marked in the treated than the untreated incipient up to the time of

discharge, but in advanced cases the comparison with similar untreated cases is in favor of the treated.

I nevertheless have formed the impression that the use of tuberculin brings about somewhat better results than can be obtained by sanitarium methods alone, even up to the time of discharge. The statistical evidence I have been able to gather, and which seems to confirm these impressions, was made for the Sanitarium records at my request by Mr. E. S. Pope, an expert mathematician, to whom my acknowledgments are due; and I present you the evidence of his exhaustive study in as condensed form as possible:

The influence of tuberculin injections on the disappearance of bacilli from the expectoration when the entire number of treated and untreated at the Sanitarium is considered, was as follows:

Of those who had bacilli in the incipient class, 64 % of the untreated 67 % of the treated lost them; of those classified as advanced on admission, 44 % of the treated lost them, and 24 % of the untreated.

In regard to the results at discharge, Mr. Pope writes: "In some years there have been few, and in other years many tuberculin cases. The standards of classification have varied from time to time. Now if there were a large number of treated cases in a year of low standard, the tendency would be to make the total results for tuberculin unduly good. If these conditions were reversed, the opposite result would be obtained. By reducing (or increasing) the numbers of treated and untreated cases to 100 in each class, in each year, this difficulty is avoided. The correct way to do this is not to select the cases, but to multiply or divide the actual numbers in each class for each year so as to make them equal to 100. This applies to the following table:"

Comparison of 185 Cases Treated and 864 Untreated

There have been excluded: All who stayed less than 90 days; all who did not have tubercle bacilli on admission.

For the reasons given above, the following percentages have been calculated on the basis of an equal number of treated and untreated in each year.

The results at time of discharge were as follows:

	Incipient.			Advanced.		
	Ap. Cured.	Dis. Arrest.	Active.	Ap. Cured.	Dis. Arrest.	Active.
Treated.	56 per cent.	34 per cent.	10 per cent.	27 per cent.	55 per cent.	18 per cent.
Untreated.	50 " "	38 " "	11 " "	6 " "	51 " "	43 " "

In considering these figures we are at once struck with the fact that the advanced cases, both so far as the loss of bacilli and the condition at discharge are concerned, seem to derive proportionately much more benefit from the treatment than the incipient class, and I will refer to this later. You all know how unsatisfactory and unconvincing conclusions based solely on statistics relating to sputum examinations and classification of results can be. The uncertainties of sputum examinations, unless several examinations extending over considerable time are made, and the personal equation of the physician cannot be excluded as influencing the classification of a patient at discharge, and are among the most obvious and misleading sources of error in such statistics.

The study of the post-discharge mortality, however, would seem to promise much more satisfactory and conclusive evidence. Through carelessness we may all fail to find bacilli though they be present; and we may all differ as to whether a case at discharge is "apparently cured" or "arrested"; but there can be no doubt as to whether the patient be *living* or *dead*. Besides, the object of sanitarium treatment is not the condition of the patient at discharge, but the prolongation of his life, and time must ever be the crucial test of any treatment. Mr. Pope has condensed for me his canvass of the post-discharge mortality, which bears on 135 treated and 690 untreated cases discharged in the past fifteen years from the institution.

Basis

Equal numbers of treated and untreated cases in each year; excluding all cases who stayed less than three months; excluding all cases who left the Sanitarium less than one year ago; excluding all untraced cases.

Percentages

	Incipient.		Advanced.	
	Living.	Dead.	Living.	Dead.
Tuberculin treated.	79 per cent.	21 per cent.	61 per cent.	39 per cent.
Untreated.	63 " "	37 " "	36 " "	64 " "

From these figures we gather that 18 % more of treated incipient cases are living than of untreated, while 25 % more of advanced cases who received tuberculin are living than of those who did not. The value of such comparative statistics, however, depends entirely on two things: the accuracy of the figures, and the explanation of the results

they represent. As to the accuracy of the figures I have little or no doubt, but I regret that I am by no means so certain of their exact value as demonstrating the curative influence of tuberculin. The question is, are the favorable results which these figures seem to indicate due solely to tuberculin treatment or to other factors?

The only sources of error with which I am acquainted are the influence of the selection of cases, and the fact that the treated remained often much longer in the institution, in order to complete their treatment, than the untreated.

It is impossible to estimate how much the selection of cases has influenced the results, and the more favorable comparative results obtained in the advanced class may be interpreted in two ways, and does not help us much in reaching a correct conclusion. Any specific curative influence of tuberculin would be shown more markedly by prolongation of life in the advanced class, where the disease was tending towards a fatal termination, than in the incipient class, in which the disease in the majority of cases inclined to arrest and cure without the aid of any specific treatment. On the other hand, selection of cases would have more influence on the results in the advanced than in the incipient class, because the advanced class is much more comprehensive than the incipient, and there is often as much difference between favorable advanced and unfavorable advanced cases as between incipient and advanced.

Having stated the facts, I must therefore leave the interpretation of the figures to the individual judgment of those who may be interested in them. Many years ago, in spite of the general denunciation of tuberculin, and long before I knew anything about the statistical evidence, I had formed the opinion that tuberculin, when carefully administered, had within certain limits a favorable influence on the course of the disease, and that the results of sanatorium treatment could be improved and made more permanent in many cases by its application. As years have passed I have seen no reason to change this opinion, which the figures I have just quoted, however they may be interpreted, do not at any rate tend to contradict.

DISCUSSION ON DR. TRUDEAU'S PAPER

Dr. Lawrason Brown, Saranac Lake: Dr. Trudeau's paper is, I believe, a most timely one. It seems to me we are at present on the verge of a general revival of the tuberculin treatment. It befits us all

to keep constantly in mind the great moderation of expression, the great care in dosage that he advocates so strongly. And, above all, let us not forget that he has emphasized that which is most important in any treatment, the individualization of each patient, with careful attention to his personal susceptibilities. Tuberculin does not fulfill any of Dr. Osler's requirements of a good medicine. It has not a good color; its taste is unknown; it is lacking in odor, and lastly and most important, it is not a harmless medicament that any one can employ by rule of thumb. If we depart from such a course and fail to be guided by the compass of greatest caution we shall undoubtedly be foundered in a hurricane, similar to that which followed the period of tuberculin delirium in 1891 and 1892.

The following remarks are based upon my own personal experience in the treatment with tuberculin of eighty-five patients. I published several years ago in the *Zeitschrift für Tuberkulose und Heilstätten-Wesen* a study more or less in detail of all the patients treated with tuberculin at the Adirondack Cottage Sanitarium up to that time. Dr. Trudeau mentioned in the first part of his paper three patients who possibly were injured by the use of tuberculin. Two of them came under my notice. The first, a young man, presented himself for diagnosis. He had had elevation of temperature at times for some little while and was rather neurasthenic. After three mg. of the old tuberculin his temperature, which had fallen to nearly normal, rose to 100° for two days and then returned to normal. He complained afterwards of not feeling well and two weeks later had an haemoptysis followed by a normal temperature. The second patient, also a young man, had been steadily losing ground. He, too, had a history of previous temperature. After a dose of solid substance he had a moderate reaction from which he quickly recovered to have after four days of apyrexia a moderate hæmoptysis followed by high fever for two weeks and a rapid advance in the disease.

Tuberculin undoubtedly produces a congestion of the tuberculous lesion, and when we consider the fine structure of the lungs it seems strange that slight blood-spitting is not more frequent after the injection of tuberculin. In all ten instances of hæmoptysis more or less connected with or at least following the injection of tuberculin have come under my notice. In no case was the hæmoptysis severe and in the majority it was slight, or as West terms it, "streaky." In eight patients previous hæmoptysis had occurred and in only one instance

was there any marked febrile reaction after the hæmoptysis. In all cases where hæmoptysis was recorded it occurred in one to three days after the injection. In four cases there was no abnormal rise of temperature. In three instances a temperature of 99.4, 99.6 and 100 degrees followed the injection. When it is considered that in our 2,500 injections of tuberculin, given to eighty-five patients, of all stages, including many patients with advanced disease, many of whom had previous hæmoptysis, that such a small number of hæmoptysis should occur during a course of treatment that extended over in some instances six months and rarely less than five, when all this is considered, it seems almost as if these few hæmoptysis might be looked upon, in part at least, as coincidences.

Dr. Trudeau has advised great caution in avoiding reactions. My experience leads me to believe that in many patients there comes a period of increased susceptibility when the patient reacts more readily even to doses which before caused no reaction. Great care must be exercised until this period is passed. In patients who previously have been subjected to the tuberculin test this increased susceptibility may supervene sooner, that is, to a smaller dose.

It may be of interest to note here that in seventy patients treated with tuberculin no reactions occurred during the whole course of the treatment in twelve, one reaction in fifteen, two in thirteen, three in ten, four in seven and five to eleven reactions in thirteen patients. In other words, fifty of these seventy patients had three or less reactions during their course of tuberculin treatment until large doses were reached (over 100 mgs. of the old tuberculin, or over 1 mg. of solid substance of the bacillen emulsion).

It may be of some interest to those of you who may contemplate the use of tuberculin to know that seven per cent. of our cases treated with B. E. first reacted to a dose of one or more thousandths of solid substance, 48 per cent. to some hundredths, 43 per cent. to some tenths, and 12 per cent. did not react until they reached a dose of one or more mgs. Over 50 per cent. of the patients treated with the old tuberculin first reacted to 0.3 to 0.7 of a mg. The smallest dose to which any patient reacted was .005 mgs. solid substance of the B. E. and 0.1 mg. of the O. T.

It may be of interest to note the other complications that have occurred during the treatment. Three cases have had nephritis. In one case it was probably due, in part at least, to exposure to cold, as the

patient had insufficient clothing. He made a good recovery and has had no recurrence. The second case developed one year after the patient left the sanatorium, during which time he worked hard and rapidly declined. The third case is apparently doing well. Two patients had one or more short acute gastro-intestinal attacks, usually during the night following the injection. Nausea, vomiting and some intestinal disturbance were present. Two other patients, both men, developed ischio-rectal abscesses which resulted in fistulas. They reacted to slight doses before the abscess was discovered. One patient had a sterile abscess in the back, due to the injection of a large dose into the induration caused by a previous injection. This was really my fault, as I had failed to warn my assistant of the danger. We gave one patient unquestionably too much B. E., and I would never advise more than five mgs. solid substance of B. E. at one dose. She recovered fully in some weeks and has done far better than I dared hope. In a number of patients we could never increase the dose beyond a few mgs. of the old tuberculin, or some hundredths of a mg. of the B. E. (solid substance). For the most part (nine out of eleven) they had extensive lesions, one had an enlarged thyroid with some exophthalmos, and a second developed a perineal abscess. The patients, and we have certainly not selected them recently because they were favorable, have on the whole done remarkably well. I expected a number of them to " go to pieces," which they did not do, but prognosis and experience are fallacious and judgment difficult.

In conclusion, I would like to emphasize a point I have felt very keenly about; I refer to the empirical state of our knowledge of the proper dosage of tuberculin. Wright and his co-workers have endeavored to solve the problem but the results in the Saranac Laboratory have shown that with the technique there employed it would be impossible to use tuberculin and control it by following the opsonic index in any number of patients. In this connection I suggested some time ago to one of my assistants, Dr. Lupton, the study of the leucocytes during the administration of tuberculin. He has found that in the majority of cases some leucocytosis occurs, but in a few a leucopenia is present and in these instances we feel from a consideration of the other symptoms that we overdosed our patients. No conclusion, however, in regard to the dosage can be drawn from this study of the leucocytes. It seems to me that the most important point in tuberculin

treatment, and to which we should bend our energies, is the determination of some method of controlling the dosage.

Dr. E. R. Baldwin, Saranac Lake: I can only indulge in a few remarks as to theoretical considerations rather than clinical application, as I personally have had much more to do with the laboratory side. I think Dr. Brown has well expressed it in saying that it is evident to us all that tuberculin is still in the experimental stage. There are certain things about the reaction that we are not yet satisfied with. We do not know all the elements of the reaction or the explanation of these elements. Consequently, the use of tuberculin clinically is, as Dr. Brown has said, empirical. I do not mean by that that its use should be restricted entirely to people who have laboratory experience, necessarily, but it evidently requires a great deal of care in its administration.

As to the rationale of the treatment, the thing which most impresses a person who has had the opportunity of seeing the development of our knowledge on the subject is the local reaction. The essence of the treatment is the local reaction. The interpretation of that reaction is of prime importance. Many theories have been given and the most recent work that has been done has tended to clear up many previously unsolved problems and to strengthen the position that clinical observation has shown, *i. e.*, that tuberculosis can be favorably influenced by tuberculin. The local reaction is a congestion,—macroscopically, one can observe this in lupus. This congestion is difficult of explanation. I believe myself that we have here in a rough way to explain the reaction as an enzymotic process. The stimulus caused by injecting the tuberculin is exerted upon the tubercle itself. Taking a single tubercle as a type, we have first congestion, then a general reaction. The congestion may occur without any general reaction, and the best interpretation of this is explained by the enzymotic theory, by which the cells surrounding the bacilli, or its disintegrated products, are functionating in this reaction. To my mind this function is an active secretion,—an active cell function which secretes some kind of ferment—which in turn digests the toxin or tends to digest it into simpler forms which are dissolved out of the tubercle, and we have a general reaction following. The absence of this stimulus under the natural conditions in the disease leaves the tubercle unchanged except by the rather weak ferment action of these cells, the result of which is that the effect remains incomplete and localized. On the other hand, in the treated individual who has successfully withstood a great many local reactions

we have there an evidence that the tubercle cells have become able to ferment most of the absorbable toxines for themselves and change or immunize the cells elsewhere, so that the tubercle cannot longer become a menace to the individual. The truth is that the ferment action appears to be the basis of the tuberculin reaction and very likely the basis of its therapeutic value. Von Behring refers to this particular power of the cells to transform the toxin into a simpler and less harmful substance in his recent announcement of a new treatment. While the whole reaction is not as yet explained, to my mind there is sufficient evidence to-day of the value of tuberculin from an experimental point of view, and it is confirmed by clinical observation.

Dr. Arnold C. Klebs, Chicago: I have very little to say on the subject because observations in general practice are single and haven't the value of those presented by Dr. Trudeau. I believe, however, with Dr. Trudeau that we should feel encouraged in using tuberculin. In Europe particularly they have begun using it to a very great extent again and it is rather surprising to realize how little it has been used here. Dr. Trudeau's persistence in using it has enabled him to gather material which must guide us in this respect. One point I was impressed with in his paper is the great caution which he advocates. My own impressions have been more and more that we have been very careless in the use of tuberculin. Only a few years ago we used doses that we would not think of using now. As Dr. Brown has said, it is extremely difficult to control the effect of the injection. We do not know what is going on. We used at one time only the reaction as an index; now we give injections without reactions. I was impressed with the statement of Dr. Trudeau that he goes by the malaise of the patient as an index of the reaction. I have seen cases where we have had absolutely no reaction; no changes whatever; and I am convinced that in these cases we have done harm. We are looking for something to indicate where possible harmful reaction may begin. The doctor also called attention to the fact that the various tuberculins vary much in reaction. I have been impressed with that and furthermore with the fact that the various kinds of tuberculin called by the same name differ one bottle from another. A word of warning is in place here; whenever we switch from one bottle to another we should use great caution, especially with the emulsion preparations, which vary very much.

Dr. L. Rosenberg, Bedford Station, N. Y.: My experience with

tuberculin has been limited to the past year. We used it in sixty cases, and in general can report about the same results as Dr. Trudeau. We think there has been a slight but appreciable improvement in the results in early cases, and still greater in the more advanced ones. We were naturally very careful in the selection of the early cases. With these our experience differs a little from that of Dr. Brown, notably with regard to the susceptibility of the patients. My experience has been that it was quite difficult to bring some of these patients up to one mgm. A great deal of intolerance was displayed until we had gotten them up to this amount; after that we had no difficulty in increasing the dose rapidly. At first we began the treatment after the manner of Petruschky, of Dantzig, the so-called relay system, or "Etappen system," beginning with small doses of old tuberculin and running up to a hundred mgm., then stopping for three months and again resuming; but the stay of the patients being limited to one year we could not carry this out thoroughly. In the last six or seven months we have been giving the treatment according to the progress of the case. The majority could not go far above 350 mgm. of the old tuberculin; a few went as far as 700 mgm., and one to 1000 mgm. The most striking result was in one moderately advanced case with laryngeal involvement; the rales disappeared entirely and the sputum became negative; this was the case receiving 1000 mgm. The best results, I think, have been obtained with the moderately advanced cases, probably, as Dr. Trudeau states, because we exercised unusual care in their selection. To offset any possible confusion as to the interpretation of the results, we did not begin until the patient had been under observation several months and failed to improve with ordinary sanitarium routine. It is just in these cases that we are inclined to believe that we got the better results. I have learned something from Dr. Trudeau's paper. I imagine that we do not employ long enough intervals, and I shall try to carry out this idea in the future. Hypersensibility was encountered in some cases, so that we had to abandon treatment; the individuals could not be made to take more than two-twentieths mgm. of old tuberculin. Some of the European writers speak of this as a common thing, but I have not found it so. We generally begin with one-twentieth mgm. and run up slowly to one mgm., which generally takes about a month. Tuberculin for testing has been employed by us for a considerably longer time than for therapeutic uses, the number of cases being pretty nearly a hundred. I have some skepticism as to the value of the tests

in determining tuberculosis of the lungs. If one fails to find local signs, as is generally the case, there is still an element of doubt. It is the only thing that is left us, however, and we must regard the patient who reacts as tuberculous, though I am convinced that this is not absolutely reliable. Some cases display a great tolerance for tuberculin, and can be brought up to the highest doses. Reactions were avoided as much as possible; they were not frequent and extremely moderate, consisting of slight rises of temperature and a little malaise. In some of these cases the treatment was discontinued. The cases were systematically examined by the members of the staff and myself as to the possibility of progress in the pulmonary condition. Increased moisture and expectoration used to alarm us, but we found that it rapidly subsided and the local condition became better than before the treatment. As to hemoptysis: in a few cases it did occur during the treatment; there was one case with laryngeal involvement and slight hemoptyses in which we were afraid to push the treatment. A thing that interested me was the possible contraindication during menstruation, and I found that we could give it regardless of this function, and that it had absolutely no effect upon it or upon the slight rises of temperature often accompanying it. The matter of variation in the strength of the tuberculin referred to by Dr. Klebs is of great importance. We employed only the old tuberculin in vials and made our own dilutions with one-half per cent. trikresol solution. We discovered that some of the vials varied greatly, and that we had been giving our patients larger doses than we supposed. Inasmuch as a slight increase is of great moment, this is a very unpleasant state of affairs, and we now carefully weigh and measure the original vials before making our dilutions.

Dr. S. von Ruck, Asheville: At the Winyah Sanitarium we have also been seeking some practical means of control of the action and of guidance in dosage in the use of the watery extract of tubercle bacilli. Thus far, we have not found the measurement of opsonins satisfactory. However, we have found that the specific agglutinins progressively increase during treatment, positive agglutinations in dilutions of even three hundred and four hundred parts of the test fluid being finally obtained in many cases.

Occasionally former patients who have apparently recovered have returned to us for examinations and we have found that these patients show still relatively high sero-agglutinin values even after no treat-

ment has been administered for several years. How much they have lost in the agglutinating power of the blood since discharge we do not know, as we did not employ the test until about two years ago.

We have noticed that patients who failed to improve in nutrition, and did not progress satisfactorily, did not show increase in the agglutinins. While from these observations we cannot form any hard and fast conclusions, we feel that we are working along the right lines, and that the sero-agglutination reactions may be employed practically not only as a control of the specific therapy in tuberculosis, but possibly as a prognostic indication in cases under treatment.

Dr. Edward L. Trudeau, Saranac Lake: I have had very little experience with the effect of tuberculin treatment on the complications of the disease, principally on account of the fact that cases free from complications were generally selected. In cases where tuberculous nodes were present, one or two of these might go on to suppuration, the others diminishing in size, and the improvement being the same in them as in the pulmonary lesions. After caseation has occurred in a tuberculous node diminution in size does not follow under treatment, but before caseation has occurred the enlarged node may almost entirely disappear as a result of the treatment. The effect of tuberculin treatment on localized tuberculous processes is best shown in the rabbit's eye. If the inoculation has been done with a very small amount of a very dilute suspension of bacilli, the resulting tubercles on the iris may be observed to shrink and ultimately disappear, as a result of the repeated local reactions caused by the tuberculin injections.

So far as hypersensibility to tuberculin is concerned, I would not in treating a patient be discouraged by its occurrence. The only thing to do is to discontinue the injections for a time, and then begin again with small doses gradually increased. Hypersensibility is not so likely to occur if the first reaction is put off as long as possible, and this is best done by always beginning with very small doses and increasing the dose very slowly, as this seems to lay a foundation for the induction of toxin immunity.

The observations quoted by Dr. Ravenel as to the resistance of certain toxins to high temperatures are true to a certain extent for tuberculin; that is, for Koch's original tuberculin, which is little affected by high temperatures; but it should be remembered that all substances that can be precipitated by heat from liquid cultures have already been eliminated in the process employed in making Koch's old tuberculin.

If the cold filtrate of liquid cultures is put in the sterilizer a precipitate ensues, and these precipitated substances are thus eliminated from the old tuberculin when heat is used in concentrating it. For this reason the cold filtrate of liquid cultures would seem preferable to old tuberculin as an immunizing agent, and the results claimed by Denys and others with this form of tuberculin tend to support the view that heat should not be used in the preparation of tuberculin for therapeutic purposes.

THE TREATMENT OF TUBERCULOUS LARYNGITIS WITH WATERY EXTRACT OF TUBERCLE BACILLI, WITH OBSERVATIONS UPON THE ACTION OF SPECIFIC INOCULATIONS IN THE TREATMENT OF TUBERCULOSIS

By F. M. Pottenger, A.M., M.D.

Monrovia, California

Tuberculous laryngitis has long been looked upon as a most hopeless complication of a hopeless disease. The past quarter of a century has removed this hopelessness from pulmonary tuberculosis. Through wider knowledge has come early recognition of the disease, and through rational treatment its curability has become established. Tuberculous laryngitis, however, still remains a serious complication although the hopelessness has been somewhat removed from it. Its curability is now proven, and it remains for the next quarter of a century to establish it beyond question.

The importance of this complication cannot be underrated for it is present in a large proportion of the cases suffering from tuberculosis of the pulmonary form. There is a wide divergence of opinion as to its frequency. Percy Kidd[1] estimates that fifty per cent. of the cases dying of tuberculosis have the larynx affected. St. Clair Thompson[2] accepts this percentage as correct. Schaeffer[3] found only 8, or 2.6 per cent. of normal larynges in 310 persons suffering from pulmonary tuberculosis. Of these 64.6 per cent. were diagnosed as tubercular. Heinze[4] found laryngeal tuberculosis present 376 times or 30.6 per cent.

[1] Percy Kidd: Clifford Allbutt's "System of Medicine," Vol. V.

[2] St. Clair Thompson: "The Principles of Treatment of Tuberculous Laryngitis," *Trans. British Congress on Tuberculosis*, Vol. III, page 356.

[3] Schaeffer: cited by A. Fraenkel, "Specielle Pathologie und Therapie der Lungen Krankheiten," page 776.

[4] Heinze: "Die Kehlkopfschwindsucht," 1879.

of 1,226 post mortems on tuberculous subjects made at the Leipzig Pathological Institute. Schech[1] finds the larynx affected in thirty per cent. of tuberculous subjects, while Turban[2] finds only seventy-four instances, 18.3 per cent. among 408 cases of pulmonary tuberculosis. Von Ruck[3] finds tuberculous laryngitis which can be diagnosed by ordinary inspection in 260 or 45.6 per cent. of 570 cases. Careful inspection, however, after the administration of tuberculin revealed 166 more making a total of 426 or 74.73 per cent. Of ninety-four cases which the writer reported recently there were 15 or 15.95 per cent. suffering from laryngeal involvement of such a degree as to cause subjective symptoms. Of sixty-five patients in the Pottenger Sanatorium at the present time twenty-seven or 41.54 per cent. either have had or do now have sufficient involvement for the diagnosis to be made by inspection. Thus it will be seen that my percentage of cases to be diagnosed on simple inspection does not fall far short of that of Von Ruck. It should be added too, that most of the laryngeal involvements are in those who are in the advanced stage of the disease. If our inquiry were confined to the advanced cases there is no doubt but that more than fifty per cent. would show tuberculous laryngitis on examination, thus confirming the percentage of Kidd, St. Clair Thompson and Schaeffer.

This shows the importance of careful examination of the larynx in all cases of pulmonary tuberculosis, and emphasizes the necessity of a familiarity with the methods of examination and treatment of this organ upon the part of those who are treating tuberculosis, especially those who treat it in its most advanced stages.

Tuberculosis of the larynx manifests itself most often in the form of infiltration. Sometimes this infiltration breaks down and forms ulceration. Tuberculomata are also sometimes formed although they are not common. Miliary tubercles are occasionally seen and less often the disease manifests itself as a perichondritis.

The diagnosis of tuberculous laryngitis is largely a matter of experience. The physician who is in the habit of seeing these cases often will rarely be mistaken in them. The diagnosis is assisted by the fact that the disease is almost if not always secondary and rarely occurs unless

[1] Schech: Heyman's Handbuch, wein 1898.
[2] Turban: "Beitrage zur Kentniss der Lungentuberkulose," Weisbaden, 1899.
[3] Von Ruck: *Journal of Tuberculosis*, Vol. V, 1903, and Report of the Winyah Sanatorium for 1903 and 1904.

the lungs are affected. Again it is most commonly found where the pulmonary condition is somewhat advanced. While it must be borne in mind that a tuberculous patient is subject to all the forms of non-tuberculous affections of the throat, yet repeated examinations by a skilled laryngologist will rarely fail to differentiate the tuberculous from the non-tuberculous.

Here, the same as in other forms of tuberculosis, an early diagnosis is very desirable, for the prognosis is much more favorable in slight infiltration that it is in extensive ones with great thickening or after ulceration has occurred.

The prognosis in tuberculous laryngitis has always been considered grave. In fact I believe it is the opinion of nearly all physicians that when the throat becomes affected there is no hope.

Sir Morrell Mackenzie[1] wrote in 1880: "The prognosis is always extremely grave, and it is not certain that any cases recover."

Lennox Browne[2] in 1893 said: "The prognosis is seldom doubtful, and we are not justified in giving other than an unfavorable prognosis either as to recovery of health or duration of life."

Lake[3] writing in 1905 takes a much more hopeful view. He says: "If tubercular laryngitis is treated from its first commencement, the disease can be controlled, in very many cases completely cured, and in others the onset of severe symptoms can be prevented."

West[4] writing in 1902 shares the general hopeless view and says: "The prospects of cure are very slight."

Tyson[5] in the fourth edition of his Practice which is just issued says: "The prognosis of tubercular laryngitis is unfavorable at best."

Such opinions as those of Browne, West and Tyson can be multiplied many times. In fact it is difficult to find a favorable prognosis offered by any one.

In order to substantiate his favorable prognosis Lake[6] says: "In the first edition of this work I recorded forty-eight cures out of 329 cases, or 14.59 per cent.; and from 1901 to 1903 inclusive, I have to record, out of 211 cases, 44 cures, or 20.85 per cent. and 14.21 per cent. 'much improved.' The 'cures' include all cases discharged from the hospi-

[1] Quoted by Lake: "Laryngeal Phthisis," 1905, page 85.
[2] Lennox Browne: "Diseases of the Throat," 1893, page 418.
[3] Lake: *Ibid.*
[4] West: "Diseases of the Organs of Respiration," page 81.
[5] Tyson: "Practice of Medicine," fourth edition, 1906, page 512.
[6] Lake: "Laryngeal Phthisis," 1905, page 85.

tal with no visible lesion of the larynx (scars, etc., excepted); many cases were in an early stage, and many very slight cases of cord trouble are included."

This very gloomy picture showing only one out of five cases of tuberculous laryngitis as cured when "many cases were in an early stage, and many very slight cases of cord trouble are included," is one of the brightest that can be found. It is even dazzling when compared with others.

How different this is from the report of von Ruck[7] who obtained either a disappearance of all signs or a condition no longer reacting to tuberculin in 353 or 82.86 per cent. of 426 cases of laryngeal involvement treated at the Winyah Sanitarium.

In a recent paper[8] the writer reported 94 cases of pulmonary tuberculosis complicated in fifteen instances by laryngeal tuberculosis, all of which were sufficiently advanced to cause symptoms on the part of the patient. Of these fifteen cases there was apparent healing so that there was no further reaction to tuberculin in eleven or 73.33 per cent. In one other case there was a healing of a large ulcer and an arrestment of activity although still reacting to tuberculin. At the last report which was more than a year after discharge the throat was still in an arrested condition. To these could be added several more cases who are cured of their laryngeal involvement but who are still under treatment for their pulmonary condition, but I will confine my report to these fifteen cases.

Before entering upon the subject of treatment I wish to say a few words about early diagnosis. It is not necessary to emphasize before this body the necessity of early diagnosis in pulmonary tuberculosis, for doubtless nearly everyone here has been teaching the necessity of this; but I feel that we should broaden our teaching and insist upon the early diagnosis of tuberculosis wherever found. We should not be satisfied with an examination of the chest but we should examine for tuberculosis elsewhere, and above all the larynx should never be neglected; for, even conservative men estimate that one-third of those who have pulmonary tuberculosis, have the larynx affected, and the evidence is quite clear that in advanced cases one-half would be within the truth.

[7] von Ruck: *Loc. cit.*

[8] Pottenger: "Results of Treatment in 94 Cases of Pulmonary Tuberculosis," *American Medicine*, 1906.

As the time to treat the pulmonary form is in its incipiency, so is it of the laryngeal form and the prognosis becomes the more grave the farther advanced the condition. So I would not only plead for an examination of the larynx in all cases of pulmonary tuberculosis, but also for an early diagnosis of laryngeal tuberculosis and for the immediate institution of rational treatment.

In treating this form of tuberculosis, it must be borne in mind that it is nearly always secondary to tuberculosis elsewhere in the body, usually in the lung; and any line of treatment which is expected to be of value must include the treatment of the other conditions present. We must not expect to heal tuberculosis of the larynx by local applications in very many cases, nor must we expect to accomplish our results quickly. It is a matter of time and patience. We must not expect very satisfactory results except in institutions where the patients are under constant care and guidance and where they can be cared for for a prolonged period of time.

The indications for treatment then are the same as for the treatment of tuberculosis elsewhere. The conditions which we wish to bring about are the same, and as follows:

1. To increase the resisting power of the patient.
2. To prevent the disease from spreading to new tissue.
3. To heal out the local lesion.

The resisting power of a patient is supposed to depend very largely upon his nutrition, hence all those things which tend to improve this, such as open-air, hygienic living, good food, carefully regulated rest and exercise, hydrotherapy and various other tonic measures all find place in the treatment of tubercular laryngitis.

In order to cure the local ulceration, Krause[1] introduced lactic acid in 1885; and in 1887 Heryng[2] advocated the curetting of the tuberculous process and after-treatment with lactic acid, hoping in this way to eradicate the disease so that it could not spread. While this surgical treatment is not founded on a rational basis, because it is not often possible to extirpate all the diseased area and consequently if healing takes place it usually soon ulcerates again, yet the work of Krause and Heryng undoubtedly has done much to advance the treatment of this

[1] Krause: *Berlin klin. Wochenschrift*, 1895.
[2] Heryng: "Die Heilbarkeit der Larynxphthisi und ihre chirurgische Behandlung."

affection by calling attention to the fact that it could sometimes be cured.

To prevent the disease from spreading, and to heal the local lesion we have one method of treatment which offers great hope, that is inoculation.

Inoculation of specific toxins imitates nature's method of curing disease. Recent studies in immunity show that the specific antibodies which bring about a cure in diseases of microbic origin are produced by stimulation of the body cells by means of specific toxins. If the quantity of toxin is small the cell responds by the formation of antibodies; if the quantity of toxin is large the cell is destroyed and the cure prevented. Therefore by the inoculation of specific toxins in the proper amounts we can increase the defensive powers of the organism. That this occurs we believe from clinical experience, and we can prove by laboratory methods.

The toxin used in the treatment of tuberculosis is usually known as tuberculin. Tuberculin is a broad term which includes several different preparations, as old tuberculin and new tuberculin (Koch), Hunter's modification of old tuberculin, antiphisin (Klebs), tuberculin (Denys), tuberculin (Beraneck), watery extract of tubercle bacilli (von Ruck), P. T. O. (Spengler) and numerous others. The action of all these various tuberculins is similar, in part, yet different. Some are much safer to use than others and some seem to produce better results than others.

My experience with P. T. O. (Spengler) is very encouraging. P. T. O. is made from bovine bacilli. Its use will throw light upon the question of the identity and intertransmissibility of bovine and human bacilli. These tuberculins are very different. P. T. O. will immunize against the human toxin much stronger than the human will against the bovine toxin, for example: when we have carried our dosage of P. T. O. up to, say, one hundred milligrammes we can begin and within a very short time attain a high dosage of human tuberculin. When we have arrived at a dosage of one hundred milligrammes of human tuberculin, however, and wish to change to P. T. O. we must increase our dosage of P. T. O. much slower.

P. T. O. will also raise the agglutinating power of the blood to a much higher degree than the human tuberculin and this power of agglutination will last longer[1]. The reactions from the products made from bovine and human bacilli differ also.

The preparation that I have used for the most part and the one which I have used in all the cases reported here is the Watery Extract of Tubercle Bacilli (von Ruck). This preparation is made from the powdered bodies of tubercle bacilli, by extraction with distilled water after the culture fluid has been removed by washing and the fats by extraction with alcohol and ether. The product is standardized so that a given solution known as Solution No. 100, represents one per cent. of the solid matter derived from the bodies of the bacilli by the above method of extraction. The dilution is made with normal salt solution to which two-fifths of one per cent. of carbolic acid has been added. This preparation represents a greater amount of soluble extract from the bodies of the bacilli than any other and hence is presumably superior in its immunizing properties. It is a stable preparation and can be kept for months without deteriorating, which facilitates ease and economy of administration.

In order to understand the manner in which these remedies produce their beneficial action, it is well to inquire into the manner in which the disease spreads in the body and also into nature's way of affecting a cure.

Tuberculous processes usually show a tendency to spread to adjacent parts, and the lesion itself heals very slowly if at all. Any remedy then which will stimulate healing in the local lesion and any remedy which will counteract the tendency of the disease to spread will meet the two principal indications in the treatment of tuberculosis.

Man is naturally, when in health, resistant to tuberculosis. He is able to take moderate quantities of tubercle bacilli into his system without infection resulting. The normal resisting power of the body overcomes the invading organisms. If, however, the number of bacilli becomes greater, or if the inoculation be of a very resistent race of bacilli or, if the normal resisting power of the individual be lowered, then infection is likely to occur.

Here, then, lies the explanation why tuberculosis is easier to cure when the lesion is small. There are fewer areas from which the disease is attempting to spread and consequently the defensive powers of the organism are not so heavily taxed in destroying the bacilli which are attempting to form new foci; and the larger the focus the more the

[1] Spengler: "Ein neues immunisierendes Heilverfahren der Lungenschwindsucht mit Perlsuchttuberculin." *Deutsche med. Woch.*, Nos. 31 and 34, 1905.

natural defenses of the organism are depressed. This also explains why the maintenance of nutrition as is done by the hygienic-dietetic-open-air treatment, is so important. A high degree of nutrition enables the organism to form more defensive bodies than a low degree.

That the natural resisting power of the organism is lowered when an infection occurs has been shown by the important works of Bullock[1] in determining the opsonic power of the blood.

When an organism has been infected with a certain microorganism, the power of the blood for destroying that specific organism becomes lowered. In individuals suffering from tuberculosis, this power is sometimes reduced a quarter, a half or even three-quarters.

The opsonic power of the blood can best be raised by inoculation with a specific toxin. If the individual be suffering from a staphylococcus infection, the opsonic power of his blood toward the staphyloccus is lowered and can be increased by inoculation of staphylococcic vaccine; if a tuberculous infection, the opsonic power is raised by inoculation of toxins from the tubercle bacillus or tuberculin.[2] By the proper use of tuberculin the opsonic power of the organism can be raised from one quarter, one half or three quarters of the normal to above normal.

Tuberculin then is indicated in the treatment of tuberculosis because it will increase the power of the blood to destroy bacilli, thus aiding in

[1] Bullock: "On the Variation of the Opsonic Power in Health and Disease," *London Hospital Gazette*, 1905, XI, March.

Bullock: "Inquiry into the Opsonic Contest of the Blood Serum in Healthy Individuals, and in Patients affected by Lupus," *Trans. Path. Soc.*, 1905, Vol. LVI, page 334.

[2] Wright: "A Note on the Serum Reaction of Tubercle, with Special Reference to the Intimate Nature of Agglutination Reactions Generally, and to the Therapeutic Inoculation of the New Tuberculins," *Lancet*, 1903, May 9.

Wright: "On the General Principles of the Therapeutic Inoculation of Bacterial Vaccines as Applied to the Treatment of Tuberculous Infection," *Lancet*, December 2 and 9, 1905.

Wright and Douglas: "An Experimental Investigation of the Role of the Blood Fluids in Connection with Phagocytosis," *Proceedings of the Royal Society*, 1903, Vol. LXXII.

Wright and Douglas: "Further Observations on the Role of the Blood Fluids in Connection with Phagocytosis," *Proceedings of the Royal Society*, 1904, Vol. LXXIII.

Wright and Douglas: "On the Action exerted upon the Tubercle Bacillus by the Human Blood Fluid, and on the Elaborations of Protective Substances in the Human Organism, in Response to Inoculations of a Tubercle Vaccine," *Proceedings of the Royal Society*, 1904, Vol. LXIV.

Bulloch: "The Principles Underlying the Treatment of Bacterial Diseases by the Inoculation of Corresponding Vaccine," *Practitioner*, November, 1905.

Bulloch: "The Treatment of Tuberculosis by Tuberculin," *Lancet*, December 2, 1905.

the destruction of the germs in the foci which are present, and also protecting the organism against further invasion. One of the difficulties encountered in the treatment of tuberculosis lies in the fact that the bacilli are shut up in the tubercles, where the blood cannot reach them easily. Hence cure is slow. The organisms which make their way out of the tubercles, however, and which tend to set up lesions in adjacent or distant parts can be reached, and if they can be bathed in a serum rich in protective substances they will be destroyed before they can cause infection; unless, as stated above, they be very virulent or come in too large quantities.

Tuberculin does more than this. It stimulates the tuberculous focus and hastens healing. Following an injection of the proper dose of tuberculin we have a slight hyperæmia of the area involved, which passes off sometimes within a few hours, sometimes after two or three days. By keeping up this stimulation at proper intervals for sufficient time we are assisting nature very materially in her effort to cure the lesion.

The larynx is the ideal location for a lesion to be treated by tuberculin for the dosage can be controlled absolutely by the local reaction produced. The larynx should be watched daily, and the dosage should not be increased beyond that which is necessary to produce a slight local reaction; nor should a second injection be given until all reaction produced by the first has disappeared.

Tuberculin administered in this manner, will cure many cases of tuberculous laryngitis. It will increase the chances of recovery in these cases from fifty to seventy-five per cent. and in many cases it will offer practically the only hope.

In conjunction with it, all measures which will improve nutrition should be used. The local lesion should be kept clean by suitable bland sprays.

If ulcerations are present, they may be treated with protargol ten per cent. and if painful should be dusted with orthoform. At times when pain is excessive and cough very troublesome, this may be allayed by adding one-twelfth grain of heroin hydrochlorate to the orthoform. Rest of the larynx should be insisted upon. The patients should be requested to talk as little as possible, and when necessary, preferably in a whisper. Cold compresses to the throat at night aid in relieving cough. Focusing the sun's rays upon the parts affected after the

method of Sorgo[1] or using the violet rays seems to aid some, perhaps by causing an increase of blood to the parts and thus affording greater opportunity for the protective action of the serum.

In my practice I have never found it necessary to resort to operative procedures, nor have I used any remedies of severe action. A ten per cent. solution of protargol is as strong an application as I have made except in very exceptional circumstances. By looking after the nutrition of the patient and by the careful use of tuberculin my results have been very satisfactory. I have no hesitancy in saying that a more general use of tuberculin intelligently administered, will take away from tuberculous laryngitis much of its hopelessness, and I commend it to all those who will study its action and administer it with care. It is a powerful remedy for good, and almost incapable of harm if used correctly; it is powerful for harm and attended with danger if used carelessly or ignorantly.

DISCUSSION ON DR. POTTENGER'S PAPER

Dr. S. von Ruck, Asheville: I note that Dr. Pottenger uses the terms "watery extract" and "tuberculin" interchangeably, and I have from time to time observed in literature a great deal of confusion in the terminology of the various substances derived from the tubercle bacillus, and from the culture media upon which it is grown.

I think we should seek to avoid such confusion, for not only are there important differences in the methods of preparation of these products, but also in their action. For example, tuberculin is merely a concentration of the fluid upon which tubercle bacilli have grown and matured, while the watery extract, as prepared in our laboratory, is the solution in water of a protein or protoplasmic substance obtained, without the application of heat, from the bodies of the bacilli themselves. Tuberculin often produces inflammatory exudations which the watery extract in question never does.

There are also differences between products called watery extracts of tubercle bacilli. The watery extract of Maragliano, for instance, is produced by extracting with water under heat the tubercle bacilli as they are taken direct from the culture and contains substances which we are especially careful to exclude from our preparation.

[1] Sorgo: "Ueber die Behandlung der Kehlkopftuberkulose mit Sonnenlicht nebst einem Vorschlag zur Behandlung derselben mit kuenstlichem Lichte," *Wien. klin. Wochenschrift.* 1905, Vol. XVIII, No. 4.

Since 1897 a thousand cases have been treated with this remedy at the Winyah Sanitarium, and from our observations of this large material, we feel justified in the belief that it represents the true immunizing toxin of the tubercle bacillus.

We are confirmed in this belief: (1) Because we have been successful in protecting small animals with it against virulent experimental infection. (2) Because of the permanency of the clinical recoveries of our patients, and finally, because we have been able uniformly to greatly increase the agglutinating power of our patient's blood serum. In many cases we have finally obtained positive reactions in dilutions of from three hundred to four hundred. I am well aware that the amount of agglutinins present in the serum is not a measure of the *degree* of immunity, but agglutinins belong to the specific immune bodies, and are increased in active immunization. Moreover, we find that with this increase there is a corresponding and progressive improvement of the patient in his general nutrition, as well as in the local manifestations of the disease.

To turn now to the clinical side of Dr. Pottenger's paper, the question of frequency of tuberculosis of the larynx is of interest.

It does not seem that all of the profession have recognized that laryngeal tuberculosis, like pulmonary tuberculosis, has an early stage in which there are frequently no definite symptoms or no symptoms at all. In either case local examination often reveals decided changes that point distinctly to their tuberculous nature.

In my own clinical material I have found this to be true of the larynx in a large percentage of cases, since I have made systematic examinations of the upper air passages in all cases of phthisis. In some instances, however, the infiltrations were so slight that only a suspicion of their nature was justified and they might readily have been considered as insignificant or of catarrhal origin had they not shown local reactions to the watery extract in the ordinary course of its therapeutic use.

These reactions are never severe, as are often those to crude tuberculin, and they subside in a few hours, ordinarily without having caused subjective symptoms. Still, they are unmistakable by the experienced observer, and there is not the slightest doubt in my mind that they reveal the presence of tubercles in the tissues.

I do not believe that all such cases of beginning tuberculosis of the larynx would advance to the stage of ulceration or serious structural

change, and there is as much reason to conceive a latent laryngeal tuberculosis as a latent tuberculosis of the lung, or of any other organ. Nevertheless, a more general recognition of these facts, especially on the part of laryngologists, would not only lead to an earlier diagnosis of the laryngeal disease but often of the pulmonary as well.

As regards the treatment of these cases, the great majority require no local measures whatever. Immunization with the watery extract is all that is essential, except in instances in which the disease has advanced to the stage of massive infiltration and deep ulceration. In such cases palliative measures to relieve distressing symptoms are of course indicated, and in this respect I have nothing to add to Dr. Pottenger's remarks.

Operative interference is rarely necessary, and I have had occasion to resort to it in only about one per cent. of a series of several hundred cases and then for the relief of dyspnœa due to mechanical obstruction of the glottis.

Lactic acid and other caustics I seldom ever use, and I have come to look upon any routine local treatment of a tuberculous larynx, merely because it is tuberculous, in the light of meddlesome interference.

The watery extract is no longer in an experimental stage. It has stood the clinical test of nearly ten years, not only in the hands of its author, who might be accused of a prejudice in favor of his own preparation, but hundreds of physicians have used it and are using it with satisfactory results all over this country, without the advantages of institution facilities or favorable conditions of climate.

REVIEW OF THE WORK UPON THE OPSONIC INDEX (WRIGHT AND DOUGLAS) IN TUBERCULOSIS

By Nathaniel Bowditch Potter, M.D.

New York

Before outlining the work upon the Opsonic Index in tuberculosis, I have thought it proper to review very briefly the experiments and papers upon the Opsonic Index in other infections and to preface a few introductory paragraphs, so that those of you who are not familiar with the subject may secure at least a frame-work in explanation of how opsonins were discovered and what part they are supposed to play in infection and immunity.

Ehrlich's theory developed the conception that before a bacterial intoxication could take place a definite chemical union must exist between the cells of the affected individual and the toxins of the invading microbe. Wright named the various toxins "tropins" because they are substances which turn towards a cell. He calls the toxin of tetanus a "neurotropin," because it combines with the nerve cells. Such a union between tropins and cells calls forth a reaction upon the part of the infected individual to produce so-called "antitropins" which are protective substances. Many kinds of antitropins exist—antitoxins, agglutinins, precipitins, lysins, opsonins, etc. A sufficient amount of such substances within the body is responsible for the existence of natural immunity on the one hand, while their elaboration is capable of conferring an artificial immunity. The art of immunization consists in developing in the animal in question the best conditions for a maximal antitropin formation.

Metchnikoff's patient investigations into the secrets of immunity are all based upon his fundamental conception that the existence or cultivation of immunity depends upon the digestive action of certain cells of the body—"phagocytes." Ehrlich's hypothesis and recent con-

tributions to the study of immunity have, however, compelled Metchnikoff to include under the term "phagocyte" a number of cells of different origin. Although he has been obliged to acknowledge the existence of antitropins in the fluids of the body, he has persisted so valiantly with his original conception that he now holds that these bodies are derived from some chemical process, a sort of fermentation, going on inside the phagocytes.

At the other extreme the advocates of the humoral theory believe that phagocytosis is a secondary process, a sort of scavenging which may occur after the germs have been injured or in some way affected by elements existing in the humors.

Denys[1] and Leclef were the first (1895) to produce reliable experimental evidence[2] that there exists in the blood serum of vaccinated rabbits substances which alter microbes in such a way as to permit their digestion by the leucocytes. From careful experiments in vitro they concluded that in a vaccinated rabbit the leucocytes obtain their power of engulfing the streptococcus from some property of the serum. The vaccinated animal fights the streptococcus first by the direct action of its serum, secondly, by its leucocytes. The latter always owe to the serum the commencement of their power.

Bordet[3] was unable to confirm their results.

Mennes[4] showed (1897) that the immunity of guinea-pigs vacci-

[1] *La Cellule,* XI, p. 178.

[2] A summary of their conclusions follows:

1. The serum of normal rabbits exercises no bactericidal action upon the streptococcus pyogenes.

2. The serum of a rabbit upon whom a certain degree of immunity to streptococcus has been conferred by vaccination, will delay the development of streptococcus for several hours and will sometimes exhibit a true bactericidal power.

3. Leucocytes from a normal rabbit added to the serum of a normal rabbit exhibit only a feeble phagocytic power to streptococcus. The leucocytes die before their usual term of life.

4. Leucocytes from a normal rabbit added to the serum of a vaccinated rabbit energetically destroy streptococcus. The leucocytes preserve their normal duration of life.

5. Leucocytes from a vaccinated rabbit added to its own serum act the same as above (4).

6. Leucocytes from a vaccinated rabbit added to the serum of a normal rabbit act as above (3).

7. If a dose of streptococcus, lethal for a normal rabbit, is injected into the pleura of a vaccinated rabbit, the serum prevents the development of a pleurisy.

8. If a dose of streptococcus capable of producing erysipelas in a normal rabbit is injected under the skin of a vaccinated rabbit the infection is prevented especially by leucocytes.

[3] *Ann. Pasteur,* 1897, p. 201 note.

[4] *Zeit. f. Hyg.,* 1897, XXV, p. 413.

nated with toxins or cultures of pneumococci, depends upon a modification of their serum whereby an active phagocytosis is produced, and that the leucocytes themselves possess no specific peculiarity.

Leishman[1] devised (1902) a method of quantitatively estimating the phagocytic power of different sera to staphylocci as a measure of the resistance of such sera to infection. He used equal quantities of blood and emulsion of staphylococci in salt solution, mixed them in capillary pipettes, blew out a drop of the mixture upon one end of a slide, upon the other end a drop of a similar mixture from a control specimen, covered with cover glasses, and incubated for one-half hour in a moist chamber. After sliding off the cover glasses, the preparation was fixed and stained. By counting the number of staphylococci in a certain number of leucocytes in both specimens and comparing the two, he obtained a "phagocytic index." He plotted a curve upon a case of acne which Wright was vaccinating.

Wright (1902)[2] showed that the inoculation of sterilized cultures of staphylococci in small doses raises the agglutinating power of the blood to staphylococci. A year later[3] he estimated the phagocytic index of the blood by Leishman's method, and showed that the patient's phagocytic index is raised to all staphylococci, but more decidedly to his own than to the staphylococci from some other patient. The patients reacted locally to some extent to the inoculation. He pictured curves showing the phagocytic index so modified by inoculations, and laid stress upon the correspondence of this curve with the clinical symptoms. He emphasized the constant occurrence of a negative and positive phase, and advanced his law of the ebb and flow and subsequent maintenance of a high phagocytic index.

He cited six cases of very obstinate staphylococcus infection including sycosis, boils, acne, etc., which he had treated by vaccination. These cases were selected as being particularly intractible. Various medical and surgical measures had been previously tried without success. Some were apparently cured by the vaccination; all showed a marked improvement. He suggested the possible utility of vaccinating patients before operations, especially operations upon the nose and mouth; also of treating gleet, bronchitis, ozaena, bacteriuria, etc.

The first mention of the word "Opsonin" occurs in a communi-

[1] *Brit. Med. Jour.*, 1902, I, p. 73.
[2] *Lancet*, March 29, 1902.
[3] *Proc. Roy. Soc.*, 1903, Vol. LXXII.

cation by Wright and Douglas entitled, "The Role of Blood Fluids in Connection with Phagocytosis."[1] They selected this word (from the Latin verb opsono, I prepare the food for) to characterize the substance which they believe prepared the microbes for ingestion by the phagocytes. They showed that the plasma and the serum exerted the same action upon phagocytosis; in other words, the plasma and serum contain the same amount of opsonin. They showed that the opsonin was thermolabile, destroyed by heating to 60° C.—that no inhibiting substances could be developed in serum by heating, because 0.85 per cent. salt solution produced no more phagocytosis than the heated serum, and that the activity of phagocytosis decreases at the same rate when unheated serum is diluted with sodium chloride as when diluted with heated serum. They proved that the serum acts upon the microbes and not upon the white corpuscles, and that the cardinal factor in phagocytosis exists in the serum. The following experiments were responsible for their conclusions:

1. Staphylococcus emulsion + phagocytes + NaCl solution at 37° C. for fifteen minutes: no phagocytosis. Add serum, phagocytosis occurs.

2. Three vols. washed corpuscles + three vols. serum at 37° C. for fifteen minutes, then heated to 60° C. (destroying the thermolabile opsonin). Cool, + one vol. emulsion staphylococci at 37° C. for fifteen minutes; result is little or no phagocytosis.

3. Three vols. serum + one vol. emulsion staphylococci at 37° C. for fifteen minutes, then heated to 60° C. + three vols. corpuscles at 37° C. for fifteen minutes; result is marked phagocytosis. Hence action of serum is mainly to modify the bacteria in such a way as to render them a prey to the phagocytosis.

Neufeld and Rimpau (1904),[2] without referring to Wright's work, alluded to the two well proved antitropic elements in immune sera (*i. e.*, antitoxine and bactericidal substances) and stated that they had found a third property of immune serum, which they claimed sensitized the bacteria but did not act upon the leucocytes. They digested leucocytes in antistreptococcus serum, suspended them in normal serum and found that they did not ingest virulent streptococci (note that they employed virulent organisms). On the other hand, after treating

[1] *Proc. Roy. Soc.*, September 1, 1903, LXXII, p. 357; LXXIII, p. 130.
[2] *Deut. med. Woch.*, 30, September 29, 1904, p. 1458. *Zeit. f. Hyg. u. Infect.*, 1905, II, p. 283.

virulent streptococci with antistreptococcus serum and then washing them free from the serum with salt solution, they found that leucocytes could then actively ingest these sensitized microbes. They obtained corresponding results with pneumococci. They proposed to call their sensitizing substances "bacteriotropic" substances. Since other distinct substances have been included under this term it seems more fitting to agree upon the very appropriate name "immune opsonins" suggested by Wright and Douglas.

With this brief account of the earliest investigations contributing to our knowledge of posonins, I now wish to insert the results of various experimental observations which were undertaken with the effort to clear up the nature of opsonins.

Individuality of Opsonins

Sawtchenko[1] and Dean[2] consider that immune serum derives its so-called opsonic action from the presence of amboceptors, because immune opsonins are relatively thermostable. Hektoen,[3] on the contrary, regards opsonins as distinct from amboceptors, and in proof of his opinion, states that normal serum may under certain circumstances possess lytic but not opsonic power and vice versa; again, that immunization may give rise to opsonic but not to lytic substances, and further, that heat may destroy the opsonic power without effecting the lytic amboceptors and vice versa.

Relation of Opsonins to Amboceptors

The opsonin for anthrax bacilli present in the serum of normal dogs is destroyed by heating at 60° C. for thirty minutes. The amboceptor for anthrax bacilli present in the serum of normal dogs is not affected by heating at 65° C. for thirty minutes. The serum of white rats is normally anthracidal, due to the presence of a thermostable substance that is neutralized by neutralization of the serum with oxalic acid. The same serum contains a thermostable opsonin for anthrax bacilli which, however, is not neutralized by oxalic acid.

Relation of Opsonins to Antitoxins and Bacteriolysins

I have just mentioned Neufeld and Rimpau's investigations upon antistaphylococcus and antipneumococcus sera in proof of the differ-

[1] *Ann. de l'Inst. Pasteur*, 1902, XVI, p. 107.
[2] *Proc. Roy. Soc.*, 1905, LXXVI, p. 506.
[3] *Jour Am. Med. Assoc.*, May 12, 1906, p. 1411.

ence between opsonins and antitoxins and bacteriolysins. Walker's[1] experiments with diphtheria bacilli and tubercle bacilli showed that toxins as well as opsonins produce an effect upon phagocytosis, but that they act independently of one another. Opsonins may be considered analogous to toxins and complements, because they also have two distinct groups—haptophore and opsonifore. Like complements opsonins may be neutralized or bound by various salt solutions, Ca, Ba, $MgCl_2$, K_2SO_4, $NaHCO_3$, etc., and so prevented from acting upon bacteria.

Relation of Opsonins to Stimulins

In his treatise on "Immunity" Metchnikoff described a series of experiments conducted by himself, Gengou Klemperer, Besredka, and others, in which the introduction of serum, sometimes normal, sometimes immune, into the serum sacs of experimental animals demonstrated a greatly enhanced phagocytic activity in the leucocytes of the exudation subsequently removed from the sac for examination. To the substances which these observers conceived to be present in such sera, they gave the name "stimulins" and to the presence of these stimulins in immune sera, Metchnikoff and his school attributed an important role in the processes of both active and passive immunization.

[1] *Jour. Med. Research*, November, 1905, p. 173. His conclusions follow:

1. Heating bacilli of diphtheria at 70°–100° C. (and so destroying their toxins) diminishes their susceptibility to phagocytes of human blood.
2. Diphtheria antitoxin will apparently not neutralize those affinities of the toxin of the bacilli of diphtheria which stimulate phagocytosis.
3. Heating serum of human blood at a temperature of 60° destroys the opsonins.
4. Heating both bacilli and serum reduces the ingestion of the bacilli of diphtheria by the leucocytes of human blood to a minimum.
5. The relative influence of the opsonins of the blood and of the toxin of the bacilli of diphtheria on the ingestion of these bacilli by the leucocytes of human blood, as shown in five tests, is expressed by the formula:

$$\frac{\text{opsonin}}{\text{toxin}} = \frac{+4.8}{+3.2}$$

6. Heating tubercle bacilli at 80 to 100° C., and so destroying their toxilbumin, increases their susceptibility to the phagocytes of human blood.
7. Heating serum of human blood at 60° C. destroys the opsonins.
8. Heating both serum and bacilli increases phagocytic activity more than if only the serum is heated and less than if only bacilli are heated.
9. The relative influence of the opsonins of the blood and of the toxin of tubercle bacilli on the ingestion of these bacilli by the leucocytes of human blood, as shown in four tests, is expressed by the formula:

$$\frac{\text{opsonin}}{\text{toxin}} = \frac{+0.97}{-1.10}$$

10. Opsonins and toxins act independently of one another on phagocytosis.

Wright and Douglas[1] endeavored to determine whether unheated serum contained "stimulins" in addition to opsonins. They found the same difference between the action of heated and unheated serum towards staphylococci heated to 115° C. as toward living germs. Their expectations were based upon the fact that typhoid bacilli heated above 70° C. acquire a resistance to bacteriolytic effect. Although their experiments with particles of India ink and carmine were unsatisfactory, unheated serum seemed to facilitate their phagocytosis slightly more effectually than heated serum. Staphylococci plus unheated serum were digested in an incubator for varying times and then divided into two portions. The first was immediately mixed with corpuscles, the second was first heated to 60° C. and then mixed. In every case the phagocytic power was greater when the heating was omitted, and no difference could be detected in specimens left in the incubator fifteen minutes from those left one hour; thus they were obliged to leave the question unsolved.

Leishman in 1905[2] showed that sera derived from cases of Malta fever or enteric fever, or from animals immunized with living cultures of the germs of these diseases, contain substances which, when added to normal human blood, are capable of increasing the phagocytic activity of the leucocytes of that blood. He also showed that these substances were specific and thermostable,—withstanding a temperature of 60° C. for fifteen minutes.

No evidence of the presence of these substances could be found in the sera of normal men or animals. He also showed that these substances were not identical with agglutinins, that they acted directly upon the leucocytes and not upon the bacilli. Metchnikoff suggested the name "opsonic sensitizers" for these substances. Wright suggested that they might be thermostable opsonins in spite of the fact that opsonins act only upon the bacteria, while these substances, if the work and statement of Leishman are to be accepted as correct, act upon the leucocytes.

Specificity of Opsonins

The matter of specificity of bacterial opsonins has not yet been clearly determined, but in the case of a great many infective agents it seems

[1] *Proc. Roy. Soc.*, LXXII, p. 357.
[2] Leishman: *Trans. Path Soc.*, 1905, LVI, p. 344.

to have been reasonably well established. Wright's[1] experiments showed that there was a decrease in the staphylococcic-opsonic index of serum to which typhoid bacilli had been added which would suggest that different bacterio-opsonins possessed part of their power in common. Some few of our[2] sera show a variation in the opsonic index to the different organisms which we employed, notably a case of abscess of the liver and a case of pneumonia. We are about to determine whether serum which has been employed to sensitize one microorganism still possesses opsonic power for other micro-organisms.

Pearce and Winne[3] showed that haemagglutinins existed in cultures of typhoid bacilli and Hektoen[4] believes that haemopsonins may also be developed by bacteria. The specificity of haemopsonins may also depend upon the types of leucocytes used—as a rule strict specificity is usually more marked with the use of guinea-pig leucocytes than with dog leucocytes. However, immune sera as a general rule, appear to have the most marked and earliest haemopsonic effect upon the corpuscles used for immunization.

4. Duration of Opsonic Power[5]

The opsonic power of serum kept at 2° C. is practically unchanged in ten days, but is destroyed in three days if the serum is kept at 37° C.

5. Decrease of Opsonic Power

Without referring to the temperature Wright and Douglas say "Opsonic power of blood disappear gradually on standing. In five or six days it is only about one-half as much as the original."

Exposure[6] to bright sunlight for three hours reduces opsonic value about one-third.

Heat.[7]—Opsonic power is but little impaired by heat except 50° and above.

[1] Wright and Douglas: *Proc. Roy. Soc.*, LXXII, p. 357.
[2] By "we" I refer to the observations which Drs. Norman E. Ditman, Ernest B. Bradley, Millicent Hopkins, and I have made in the pathological laboratory at the College of Physicians and Surgeons (Columbia University). I wish here to express our thanks to Professors Prudden and Hiss for their kindness in allowing us this privilege.
[3] Pearce and Winne: *Am. Jour. Med. Sc.*, 1904, Vol. CXVIII, p. 668.
[4] Hektoen: *Jour. Am. Med. Assn.*, 1906, May 12.
[5] Jessie Horton: *Trans. of the Chicago Path. Soc.*, 1905, VI, April.
[6] Bulloch and Atkin: *Proc. Roy. Soc.*, LXXIV, 1905.
[7] Wright and Douglas, *loc. cit.*

Normal human serum contains an opsonin for typhoid bacilli that resists heating above 60° and there is an opsonin for anthrax bacilli in serum of white rats that resists heating to 70°.

Dean[1] believes that some of the opsonin is unaltered even by heating to 60° C., because upon exposing bacteria to heated serum over a much longer period (W. & D. originally employed fifteen minutes) some phagocytosis occurred.

Immune opsonins are more resistant to heat than the normal.

Leishman[2] and his co-workers showed that the serum of persons vaccinated against typhoid fever contained sufficient opsinin to promote some degree of phagocytosis after heating to 56° C.

Hektoen[3] mentions that he has several times noted a typho-opsonin in the serum of convalescents from typhoid which resists heating to 70° C. for thirty minutes.

Immune haem-opsonins are also thermostable.

Dilution.—The opsonic index of serum varies inversely as the dilution.

Simon[4] has utilized this principle for determining the opsonic index.

Chemicals.[5]—Hektoen and Ruediger showed that the opsonic action of serum may be diminished or inhibited by solutions, isotonic with serum of $CaCl_2$, $BaCl_2$, $SrCl_2$, $MgCl_2$, K_2SO_4, $NaHCO_3$, $Na_3H_5C_6O_7$, $Na_2C_2O_4$, $KFe(CN)_6$, formalin, lactic acid and chloroform. They suggest that certain so-called negatively chemotactic substances of which lactic acid is a good example, owe their effect to neutralization or destruction of the opsonin. The diminution of resistance to various infections produced by lactic acid and ascribed to its direct repulsion of phagocytes is therefore perhaps dependent primarily upon the anti-opsonic action of the acid.

Daboia Venom: The opsonic index is diminished upon digestion of serum with daboia venom.[6]

Typhoid: I have already noted that the opsonic index is diminished upon digestion with typhoid bacilli,[7] and that if other bacteria exist in

[1] Dean: *Proc. Royal Soc.*, S. B., 1905, Vol. LXXVI, p. 506.
[2] Leishman: *Jour. of Hygiene*, 1905, Vol. V, p. 380.
[3] Hektoen, p. 1411.
[4] Simon: *Johns Hopkins Hosp. Reports*, 1906, January.
[5] Hektoen and Ruediger: *Jour. of Infec. Dis.*, 1905, Vol. II, p. 128.
[6] Wright and Douglas: *Proc. Roy. Soc.*, LXXII, p. 357.
[7] Bulloch and Atkin: *Proc. Roy. Soc.*, LXXIV, p. 379.

serum in sufficient numbers and for a sufficient time the opsonin may be completely absorbed.

6. Non-Bacterial Opsonins

Opsonins for other cells than bacteria have been described. Hektoen[1] found opsonins for blastomycetes and probably trypanosomes. Barrat[2] and Hektoen have observed the presence of haemopsonins in the sera of normal animals. We, working with human sera, have observed it twice in the serum of colored people with tubercular lesions.

7. Relation of Opsonins to Leucocytosis

From the fact that leucocytosis is of almost universal occurrence in the course of infections, it might be thought that some relationship exists between the quantity and quality of the leucocytosis and the opsonic content of the serum.

Huggard and Morland[3] in their research on the therapeutic effect of the administration of yeast in tuberculosis found that after a preliminary rise, the number of leucocytes remained constantly below normal. As the opsonic index in these cases was at first low and later high, it was apparent that there was no direct relationship here between leucocytosis and opsonic index. The opposite effect was found by Bulloch and Ledingham.[4] They employed talliamine and sodium cinnamylicum both of which increased the number of leucocytes without increasing the opsonic index—thereby sustaining the view.

8. Source of Opsonins

The lack of any relation between opsonins and leucocytosis might be regarded as some evidence against Metchnikoff's belief that the leucocytes themselves furnish opsonin to the serum.

Denys and Leclef,[1] Wright and Douglas,[1] and Neufeld and Rimpau all showed that the opsonin exists in blood serum—not in leucocytes, but none of them attempt to explain its source.

[1] Hektoen, *loc. cit.*
[2] Barrat: *Proc. Roy. Soc.*, 1905, LXXVI, p. 524.
[3] Huggard and Morland: "Tuberculosis and its Influence on the Opsonic Index," *Lancet*, 1905, p. 1493.
[4] Bulloch and Ledingham: *Lancet*, 1905, Vol. II, p. 1603.
[5] Denys and Leclef, Wright and Douglas, Neufeld and Rimpau: *Loc. cit.*

9. Effect of Drugs upon Opsonins

Potassium Iodide.—The administration of potassium iodide has no influence upon the opsonic index. The iodide eruption is not associated with a low opsonic index.

The addition of potassium iodide in small amounts to serum does not interfere with its opsonic power.[1]

Owing to the fact that nuclein has a bactericidal action and may cause leucocytosis when introduced into the blood stream, the idea occurred to Huggard and Morland[2] in 1905 to determine whether these manifestations were also accompanied by any change in the opsonic index after the employment of nuclein or yeast.

After a single dose of three grs. of yeast the opsonic index dropped for two days and then rose some distance above the normal. As has been noted this rise in opsonic index occurred at the time when the leucocytosis was diminishing and below normal.

Nicotine.—Huggard and Morland have made the observation that some of the lowest opsonic indices in cases of tuberculosis under their observation occurred in heavy smokers.

10. Relation of Virulence of Bacilli to the Tuberculo-Opsonin

Denys and Leclef, Hektoen, and Ruediger and Hektoen and Horton[3] have confirmed Metchnikoff's fundamental conception that the increase of virulency of a certain organism goes hand in hand with its resistance to phagocytosis. They worked with streptococci, staphylococci, pneumococci and anthrax bacilli.

Hektoen[4] concludes that the organism defends itself in one or both of two ways, viz., by producing substances which are harmful to the phagocytes and by an increased resistance to opsonification. No observations have as yet been recorded as to the variability of the tuberculo-opsonin with tubercle bacilli of different virulence.[5]

The tuberculo-opsonic index in healthy individuals has been estimated by Bulloch[6] in a series of thirty-four medical students and

[1] Western: *Brit. Jour. of Derm.*, 1905, August.
[2] Huggard and Morland: *Loc. cit.*
[3] *Loc. cit.*, p. 1413.
[4] *Loc. cit.*, pp. 1414, 1415.
[5] Our figures have been estimated from cultures of varying virulence obtained through the kindness of Ewing, Theobald Smith and Baldwin. We have as yet made no comparative estimates.
[6] Bulloch: *Trans. of Patholog. Soc.*, 1905, Vol. LVI, p. 334.

thirty-two nurses. The average for the sixty-six cases was 0.95 with a maximum of 1.20 and a minimum of 0.80.

Urwick[1] in twenty individuals obtained an average of 1.006. We have made eighty-one observations[2] upon nineteen supposedly normal persons and obtained an average opsonic index of 0.988 with a maximum of 1.25 and a minimum of 0.73.

We have not attempted to make a pool of a number of supposedly normal cases as has been suggested by Wright[3] because we have found that the normals vary to some extent and so we have estimated three or four different normal sera separately in indexing each series of our cases. Then unless there was a considerable variation in the different normals we have struck an average with which to compare the sera to be studied.

Urwick[4] also proved that the tuberculo-opsonic index in healthy people does not vary from day to day.

Our series of nineteen normals estimated during the past three months shows the following variations in four persons:

0.84 to 1.18
0.81 to 1.10
0.88 to 1.10
0.92 to 1.06.

The tuberculo-opsonic index in different varieties of tuberculosis has been studied by a number of observers. Bulloch[5] examined one hundred and fifty cases of lupus from the mildest type to the most chronic and intractable and obtained an average index of 0.75, the figures as follows:

Opsonic Index.	No. of Cases.	Percentage.
Between 0.2 and 0.3	3	2 per cent.
Between 0.3 and 0.4	3	2 per cent.
Between 0.4 and 0.5	21	14 per cent.
Between 0.5 and 0.6	29	19.6 per cent.
Between 0.6 and 0.7	33	22 per cent.
Between 0.7 and 0.8	22	14.8 per cent.
Between 0.8 and 0.9	18	12 per cent.
Between 0.9 and 1.0	7	4.6 per cent.
Between 1.0 and 1.4	14	9.3 per cent.

[1] Urwick: *Brit. Med. Jour.*, 1905, July 22.

[2] For the material I wish to express our thanks to the staffs at the New York, Roosevelt, City and French, Ruptured and Crippled, and Hudson Street Hospitals, and to Dr. Linsly R. Williams.

[3] Wright and Reid: *Proc. Roy. Soc. B.*, Vol. 77, 1906, p. 194.

[4] Urwick: *Loc. cit.*

[5] Bulloch: *Loc. cit.*

TUBERCULO-OPSONIC INDEX IN VARIOUS DISEASES, EMULSION OF BACILLI GENERALLY IN 1.6 PER CENT. NaCl.

Initial.	Diagnosis.	Index.
P.	Tb. hip and spine.	1.14
R.	Tb. spine.	*0.73*
V.	" "	0.92
C.	" "	1.01
M.	" spine and empyema.	0.80, 0.80
C.	" empyema and peritoneum.	1.02, 1.02
M.	" knee.	0.78
J.	" hip.	*0.46*
S.	" " with temp.	1.00
M.	" " " "	1.17
D.	" " " "	1.13
S.	" " " "	0.80
F.	" "	*1.59*
T.	" " apyrexia.	0.75
B.	" "	0.86
R.	" "	0.85
S	" ankle.	*0.59*
G.	" "	0.75, etc.
S	" "	0.90, etc.
A.	" "	1.05, 1.18
S.	Lupus.	*0.72*, etc.
X.	Tb. pleurisy.	0.89
D.	Pulmonary Tb.	1.00, 1.05
T.	"	0.50
S.	"	0.93
G.	"	0.56, *0.25*
L.	"	*0.41*
G.	"	0.87
G.	"	0.91
J.	"	0.88
S.	"	0.89
P.	"	*1.37*
F.	"	1.00
X.	Tb. tarsus	0.85
X.	" glands, jaundice.	0.96
G.	Introthoracic growth tb. glands.	*1.51*
C.	" new growih.	0.90
H.	Sycosis and debility F. H. of Tb.	0.88
W.	Ac. tb. pneumonia.	0.84
J.	" "	0.86
C.	Pneumonia.	1.10
B.	Pneumonia.	0.92
C.	"	1.01
C.	"	1.20, 0.89
D.	Post-pneumonia empyema.	0.84
		0.86
		0.75
F.	Typhoid.	1.01
M.	"	*0.68*
B.	"	*0.68*
G.	Syphilis (secondly).	1.00
M.	Cerebral syphilis.	1.02
M.	Cirrhosis, Folin's diet.	1.13
H.	Gon. arthritis.	1.15, 1.09
A.	"	*0.67*, *0.76*, *0.79*
B.	"	0.94
X.	Ac. lymph. leukæmia.	1.33
R.	Anæmia, secondary.	0.98
D.	Purpura, KI, multiple sclerosis.	0.75
M.	Hodgkin's.	0.85
N.	Hepatic.	0.96
J.	"	0.98
X.	Osteomyelitis of tibia.	*0.51*
M.	" non-tibia.	0.91
X.	Pus kidney.	*0.78*, *0.61*
W.	Cardio nephritis.	0.95
S.	Chron. paren. nephritis.	0.95
X.	" " "	0.59
X.	Herpes zoster, hydrothorax.	1.00, 1.00
O.	Chron. gout.	0.98
D.	"	0.85
K.	Paralysis agitans, cystitis.	*1.38*, *1.38*
G.	Malig. endocarditis.	1.06
A.	Abscess of liver.	1.10
W.	Acne.	1.10
O.	"	0.86
R.	"	1.07
J.	"	0.85
M.	Ring worm of body.	0.88
C.	Fract. hip.	0.79
T.	Appendicitis.	1.04
X.	Carcinoma of stomach.	*0.67*

Urwick[1] examined fifty-four cases of tuberculosis (see chart) including a number of cases of phthisis in various stages. In many of them, especially of phthisis the index was above normal,—with variations from 0.3 to 2.6.

In thirty-three cases of phthisis, twenty-five showed an index above 1.0, seven below 1.0, and one was at 1.0.

Wright and Douglas[2] examined sixteen cases of tuberculosis (see chart) including tuberculosis of skin and subcutaneous tissues, tubercular laryngitis, cystitis, peritonitis, prostatitis and tubercular glands. The indices ranged from 0.4 to 0.9.

We have made observations on thirty-nine cases of tuberculosis as follows (see chart):

Tuberculosis of bone, including spine, hip, knee, ankle, tarsus and tibia—in all twenty-two—above 1.0 in five cases, below 1.0 in fourteen, and normal in three; fourteen cases of pulmonary phthisis varying from 0.41 to 1.37—above 1.0 in one case, below in eleven and normal in two; and isolated cases of lupus and tubercular glands ranging from 0.96 to 1.51.

We have estimated the tuberculo-opsonic index in a series of patients with varied diseases. The following table shows our results:

We have attempted to compare the tuberculo-opsonic index with the staphylococcic, streptococcic, pneumococcic, gonococcic, and colon-opsonic indices in a few cases. Our results are exhibited in the following table:

II. Methods of Determining the Tuberculo-Opsonic Index

Leishman[3] was the pioneer to devise an ingenious quantitative method of estimating phagocytosis. I have briefly outlined his technique.

Wright's[4] modification of this method is as follows: Equal volumes of (1) a bacillary emulsion in salt solution, (2) the serum to be tested and (3) washed blood corpuscles are measured in a capillary pipette fitted with a rubber teat, mixed thoroughly by blowing out on a slide several times, drawn up in the same pipette, the end sealed in the flame and then incubated for fifteen or twenty minutes at 37° C. A drop of this mixture is blown out on a slide, a smear made and fixed

[1] Urwick: *Loc. cit.*
[2] *Proc. Roy. Soc.*, 1904, Vol. LXXIV.
[3] Leishman: *Loc. cit.*
[4] Wright and Douglas: *Proc. Roy. Soc.*, 1903, Vol. LXXIV, and 1904, LXXIII.

CLINICAL SECTION

OPSONIC INDICES IN VARIOUS DISEASES TO TUBERCLE BACILLI AND OTHER GERMS

Initial.	Diagnosis.	Index to Tuber.	Index to Staphy.	Index to Pneu.	Index to Strept.	Index to Colon.	Index to Gon.
P.	Tb. hip and spine.	1.14	0.72				
S.	Tb. hip.	1.00	0.66				
D.	Tb. hip.	1.13	0.78				
R.	Tb. hip with temp. abscess.	0.85	1.00				
F.	Tb. hip sinus.	1.59	1.00				
M.	Tb. knee, apyrexia.	0.78	0.80				
G.	Tb. ankle.	0.89	0.76				
G.	Tb. ankle.	1.12	1.20				
G.	Tb. pulmonary.	0.91		0.72			
G.	" "	0.87	0.90			1.06	
P.	Tb. glands, jaundice.	0.96				1.00	
G.	Tb. glands of mediastinum.	1.50	0.90				
X.	Pleurisy tb? (chest fluid).	0.78		0.95			
	" tb? (blood serum).	0.89		1.09			
G.	Syphilis (secondary).	1.02	0.83				
H.	Gon. arthritis.	1.09	1.20				
R.	Secondary anæmia.	0.98	1.09				
M.	Cirrhosis, Folin's Diet.	1.13	0.45				
M.	Hodgkin's disease.	0.85	1.00				
F.	Typhoid.	1.01	0.77			0.94	
M.	"	0.68	1.15			1.06	
B.	"	0.68	1.07				
B.	Pneumonia.	0.92		1.12			
C.	"	1.20	0.54	0.96			
G?	"	1.01	0.94	0.76			
C.	"	1.10		0.75			
O.	Abscess of liver?	1.06	0.93	0.72		1.50	
L.	Abscess of liver.	1.10	0.61			0.17	
C.	Thoracic tumor.	1.16	0.90				
D.	Empyema.	0.75				1.17	
D.	Empyema post-pneumonic.	0.86				0.83	
N.	Hepatic.	0.96	0.85			0.46	
R.	Hepatic or ulcus V.	1.05				1.08	
J.	Icterus Catarrhalis.	0.98				1.02	
T.	Appendicitis, p. op.	1.04	1.9				
A.	Chron. Con. Arthritis.	0.67			1.00		1.10
H.	" " "	1.15					1.20
H.	Normal.	0.98	1.00				
D.	"	0.97	1.00				
B.	"	1.00	1.00	0.88			
B.	"	1.07	1.00		1.10	1.10	
D.	"	0.92	1.00		0.80	0.88	
B.	"	1.10		1.10			
B.	"	0.83		0.91			
P.	"	1.00				0.81	
B.	"	1.00				1.10	
B.	"	0.99	1.10			1.00	
B.	"	1.05				1.00	
P.	"	0.81					1.03
B.	"	1.09					1.04
A.	"	1.05					0.92
B.	"	1.00	0.97				0.98
H.	"	0.92					1.01

and stained. The enumeration of the bacilli in twenty to fifty polymorpho-nuclear neutrophiles is made under a one-twelfth oil immersion lens and an average per leucocyte obtained. This average divided by that for a normal serum constitutes the opsonic-index.

The procedure[1] for making the suspension of tubercle bacilli is as follows: The conglomerated mass of bacilli is heated at 100° C. for ten minutes and a loopful is ground up in an agate mortar, adding from time to time a drop of salt solution until about two c.c. are added, centrifugated in a small tube at high speed for from five to eight minutes until the supernatant fluid is only slightly opalescent—the bacterial suspension employed.

The washed corpuscles are obtained by receiving twenty to forty drops of blood into about thirty c.c. of a one per cent. sodium citrate in 0.85 per cent. salt solution. After centrifugating, the supernatant is pipetted off and 0.85 per cent. NaCl is substituted. They are washed thus twice and finally the salt solution is pipetted off and the upper layer of the corpuscles which is rich in leucocytes is taken for the washed corpuscles. This should be quite thick in order to make good smears and to prevent the leucocytes from breaking up.

The serum is obtained by receiving the blood to be tested in small glass capsules with curved capillary limb, allowing it to clot and then centrifugating so that the clear serum is easily accessible.

Our slides for tubercle bacilli have been fixed in formalin vapor, stained in aniline fuchsin, decolorized in acid alcohol, washed in one to one thousand sodium carbonate solution and counterstained with methylene blue.

Difficulties

Of course in a method of this kind, there are many difficulties and sources of error and an enumeration of some of those which we have met may prove helpful to others. The most difficult thing of all is to get a bacillary emulsion free from clumps and of the right strength. If too thick, the bacteria cannot be counted accurately; and if too thin, there will not be enough to strike a proper average. Counts averaging from two to five bacteria per leucocyte are to be desired. The varying opalescence of a series of tubes of barium sulphate suspension of different strengths will serve as a comparison of the thickness

[1] We have followed the details of this technique—essentially those of Wright, to whom I wish to express my hearty thanks for his kindness in personally explaining his methods.

of the bacterial emulsion. With tubercle bacilli an added difficulty is that after the bacilli are separated, they are clumped by salt solutions of any concentration greater than 0.1 per cent., and unheated bacilli are agglutinated by any blood serum. To prevent this clumping, the bacilli are heated at 100° C. for ten to fifteen minutes and the suspension is made in 0.1 per cent. salt solution.

For the sake of accuracy the capillary pipettes should be of approximately the same calibre. The "leucocytic cream" should be used fresh, otherwise the leucocytes tend to stick together.

Smears are best made by using a slide with the corner broken off and the end made rough with a file. The smears should be fairly thick and are made best by pushing the smearer. The edges of the smears are counted because most of the leucocytes collect there. It is better to select isolated leucocytes for counting or at most bunches of only two or three as the counts for these are more uniform than when whole bunches of leucocytes are counted. Cleanliness, speed and accuracy are of course very essential to good technique.

Diagnostic Value of the Tuberculo-Opsonic Index

The diagnostic value of the tuberculo-opsonic index is a subject which is just beginning to be worked upon.

Wright and Reid[1] have furnished the only contribution. Their conclusions follow:

1. Where a series of measurements of the opsonic index of the blood is persistently low, it may be inferred in the case where there is evidence of a localized bacterial infection which suggests tuberculosis, that the infection is tubercular in character.

2. Where repeated examination reveals a persistently normal tuberculo-opsonic index, the diagnosis of tubercle may with probability be excluded. (Our results would lead to a still further qualification of this statement.)

3. Where there is revealed by a series of blood examinations a constantly fluctuating opsonic index, the presence of active tuberculosis may be inferred.

4. When only a single blood examination is available—if this is low, tuberculosis, either localized or systemic, may be inferred; if the tuber-

[1] Wright and Reid: *Proc. Roy. Soc.*, Vol. LXXVII, 1906.

culo-opsonic index is high, systemic tuberculous infection, which is active or has recently been active, may be inferred. If the tuberculo-opsonic index is normal or nearly normal, neither positive nor negative conclusions are warranted. Our observations tend to confirm this statement.

5. Since there are developed in blood serum in those undergoing inoculation with tubercle vaccine or as the case may be, in those who have responded to tubercular infection, certain opsonic-like substances which resist heating to 60° C. for ten minutes, tuberculosis in those whose serum retain in any considerable degree the power of inciting phagocytosis after it has been so heated may be inferred.

Whether this point can be of much diagnostic value, would seem rather doubtful from our observations which are shown in the following tables:

TUBERCULO–OPSONIC INDEX IN UNHEATED SERUM AS COMPARED WITH SERUM HEATED AT 60° C. FOR 10 MINUTES. EMULSION OF BACILLI IN 1.6 PER CENT. NaCl.

Initial.	Diagnosis.	Unheated Index.	Heated Index.
P.	Normal.	1.0	0.03
P.	Normal.	1.04	0.02
S.	Pulmonary Tb.	1.0	0.06
G.	Pulmonary Tb.	0.59	0.03
M.	Tb. spine.	0.80	0.00
G.	Tb. ankle.	0.79	0.05
X.	Normal.	1.00	0.06
C.	Tb. peritoneum, empyema.	1.02	0.03
J.	Tb. hip,	1.20	0.02
S.	Tb. ankle.	0.75	0.02
B.	Normal.	1.08	0.06
S.	Tb. ankle.	1.00	0.2
M.	Tb. hip with temp.	1.17	0.05
R.	Dorsal Potts.	0.73	0.02
B.	Tb. hip, Psoas abscess.	0.86	0.1
S.	Tb. hip with temp.	0.80	0.1
V.	Tb. spine, paraplegia.	0.92	0.02
B.	Normal.	1.00	0.25
G.	Tb. ankle.	0.93	0.15
D.	Pulmonary Tb.	1.00	0.05
L.	Pulmonary Tb.	0.41	0.02
B.	Normal.		0.1
D.	Children of tb parents.	1.00	0.05
R. D.		0.96	0.30
K. D.		0.55	0.02
M. M.		0.84	0.03
A. M.		0.84	0.00
A. S.		0.60	0.00
M. S.		0.93	0.03
M. L.		0.49	0.00

CLINICAL SECTION

TUBERCULO–OPSONIC INDEX IN UNHEATED SERUM AS COMPARED WITH SERUM HEATED AT 60° C. FOR 10 MINUTES. EMULSION OF BACILLI IN 0.1 PER CENT. NaCl.

Initial.	Diagnosis.	Unheated.	Heated.
K. G.	Tb. ankle, ante-operation.	0.89	0.45
K. G.	" " post-operation.	1.26	1.60
E. B.	Normal.	1.00	0.23
M. J.	Normal.	1.17	0.24
J. W.	Pneumonia Tuberculosis.	0.84	0.30
J. J.	Pneumonia Tuberculosis.	0.86	0.20
M. D.	Normal.	1.02	0.14
	Normal.	0.73	0.14

TUBERCULO–OPSONIC INDEX IN UNHEATED SERUM AS COMPARED WITH SERUM HEATED AT 50° C. FOR 10 MINUTES. EMULSION OF BACILLI IN 0.1 PER CENT. NaCl.

Initial.	Diagnosis.	Unheated.	Heated.
W.	Cardio-nephritis.	0.95	0.90
S.	Tb. ankle.	1.11	1.02
S.	Tb. ankle.	1.53	1.17
J.	Tb. hip.	0.83	0.55
H.	Normal.	0.91	0.79

6. Attention has been called to the fact that the bacilli grow in regions of low bacterio-tropic pressure and observations tend to show that fluids or pus from such regions contain a much smaller amount of opsonin than the blood serum obtained in the usual way from the finger. Hence the presence of a tubercular infection when the tuberculo-opsonic index of such fluids is much lower than that of the blood serum may be inferred.

Thus far we have only estimated the opsonic index in four such cases, as follows:

1. Case of herpes-zoster with serothorax (probably non-tubercular):

   Tuberculo-opsonic index of blood serum..... 1.0
   Tuberculo-opsonic index of chest fluid..... 1.0

2. Case of tubercular caries of spine with empyema:

   Tuberculo-opsonic index of blood serum..... 0.8
   Tuberculo-opsonic index of pus from chest..... 0.3

3. Case of pleurisy with effusion (we did not know whether this was tubercular or not):

   Tuberculo-opsonic index of blood serum..... 0.78
   Tuberculo-opsonic index of chest fluid 0.89
   In this case the pneumococcic opsonic index of blood serum was 1.09
   In this case the pneumococcic opsonic index of chest fluid was 0.95

4. Case of empyema following pneumonia:

Tuberculo-opsonic index of blood serum	0.84
Tuberculo-opsonic index of pus from chest	0.00

THE EFFECT OF TUBERCULIN ON TUBERCULO-OPSONIC INDEX

"A vaccine" is defined by Wright[1] to be "any chemical substance which when introduced into the organism causes there an elaboration of protective substances, or a vaccine is a substance which induces in the organism an elaboration of bacteric-tropic elements. A tubercle vaccine, one which induces an elaboration of tuberculo-tropins."

Tuberculin or a tubercle vaccine is always a derivative of the bacterial cell and when inoculated withdraws from the organism a certain amount of protective substances. Deprived of the tuberculo-tropic substance, the cells are stimulated and replace not only that which is withdrawn, but more.

Immediately after the injection of tuberculin there is a period of diminished resistance shown by diminution of protective elements in the blood, both agglutinins[2] and opsonins[3] it would seem—the so-called "negative phase"; succeeding this, there is an inflowing of and consequent increase in the protective elements—"positive phase." Most of these protective elements rapidly disappear but leave behind in the blood a more or less permanent increase over the original.

Wright speaks of the whole sequence as the "Law of the ebb and flow and re-flow and maintained high tide of immunity."

This train of events succeeds inoculation of vaccine sufficient to cause a constitutional disturbance. When only a small dose of vaccine is given, the negative phase may be so insignificant and of such short duration as not to be capable of measurement, and the positive phase will be correspondingly diminished. On the other hand, if the dose of vaccine is too large, the negative phase will be unduly prolonged and a positive phase may not appear at all. The question of dose, then, is of the greatest importance, for if too little is employed, no therapeutic effect will result. On the other hand, too large a dose is dangerous and so lowers the resistance of the organism as to favor the multiplication of the bacteria. Such dangers with a single inoculation are of course greatly magnified by repeated inoculations. If a series of such inoculations are attempted during the negative phase,

[1] Wright: *The Clinical Journal*, November 9, 1904.
[2] Wright: *Lancet*, 1903, May 9.
[3] Wright: *Loc. cit.*

there will result a further fall in the protective substances or a "cumulation in the direction of the negative phase."

Sooner or later a point will be reached when the organism will cease to respond to inoculation and further doses of vaccine will not only do no good, but may bring the content of the blood in protective substances to a lower level than that from which it originally started.

Wright and his associates consider that the result of the vaccination cannot be estimated from the character of the constitutional disturbances but with some reason urge the daily determination of the opsonic index to measure the effect.

Wright[1] advises the smallest possible initial dose sufficient to produce any negative phase and reinoculation only after the subsequent positive phase has begun to diminish.

Wright employed Koch's T. R. tuberculin[2] (one c.c. of T. R. equal to one mg. of tubercle powder) and advises that the initial dose should not exceed 1/1000 mg. His cases reported thus far, consist entirely of localized tubercle infections and include tubercular peritonitis, cystitis, glands and sinuses following an operation for their removal, tuberculosis of the subcutaneous tissues, lupus, etc.[3]

The danger underlying the treatment of any active process in the lungs is very great, for such a case is absorbing tuberculin from the site of infection and his life according to Wright consists of a succession of negative and positive phases. So long as we cannot regulate the amount of bacterial substances absorbed, the physician would only be adding to the danger by inoculating the tuberculin. This refers of course especially to those cases of tuberculosis running a temperature and which are more or less systemic infections.

The following curves show how exercise and operation may influence the opsonic index by increasing the flow of lymph through tuberculous foci, the result being as if tuberculin had been administered. They serve also to show how dangerous it might be to further inoculate such cases, there being no way of course to regulate the dose of tuberculin absorbed by the organism from *his own* focus or foci of infection.

Wright also cites cases of two phthisical cases whose indices had

[1] Wright: *Lancet*, December 2, 1905, p. 1598.

[2] The effect of protective inoculation of tubercle vaccine on rabbits has been studied by E. R. Baldwin and his associates at Saranac Lake, New York, with somewhat negative results as to the opsonic content of bloods compared with the agglutinating reaction and would seem to be rather more complex than Wright believes.

[3] Wright: *Loc. cit.*

never been lower than one. They took part in a dance, both became ill and their indices declined to 0.12 and 0.33 respectively; another phthisical patient whose index fell as a result of overwork to 0.2 from a level of over 1.0.

I have not attempted to criticize any of the work outlined above for the evident reason that my subject is merely a review. The delay in mastering the difficulties of the technique, despite my own good fortune in seeing Professor Wright and his associates at work, and the comparatively few observations we have made, would in any event prohibit a very definite opinion upon my part. For the present we intend to continue the work, purely upon clinical cases of all kinds of infections. Although diagnosis may not be materially aided, and treatment particularly with tuberculin, as suggested by Dr. Kinghorn yesterday afternoon, may not require such elaborate and repeated blood examinations, it may be that some assistance towards accuracy in prognosis may be forthcoming. Continued observations and time will decide.

DISCUSSION ON DR. POTTER'S PAPER

Dr. E. R. Baldwin, Saranac Lake: Dr. Baldwin expressed his great appreciation of the laborious work of the writer and his assistants. He was intensely interested in the work, but thought all that could be said at present was that it was a valuable report of progress along this line. He thought that while we should not have any great enthusiasm as yet, there was reason to think that we should continue to study the "Opsonic Index," and the doctor was justified in expending the time and money in doing this work. Professor Wright himself had said he felt some doubt as to its value in pulmonary tuberculosis and that there was great discrepancy in the index from time to time in patients apparently doing well. He thought all these things would be explained in time and perhaps the method would be of value in the future.

HÆMATOLOGICAL STUDIES IN TUBERCULOSIS

By Arnold C. Klebs, M.D., and Henry Klebs, M.D.

Chicago

Not very long ago the opinion prevailed that in tuberculosis and particularly in its pulmonary form examination of the blood could not reveal any marked changes, such as one would anticipate from the apparent anæmia and the more or less marked lesions in the lungs. This refers more particularly to the condition and number of the erythrocytes and to the hæmoglobin, the leucocytes receiving only scant attention and the reports of alterations in their number were confusing and contradictory. A very good historical review of this subject has recently been given by Ullom and Craig[1] and was reprinted in the Transactions of this Association, so that it is not necessary for me to enter into it again. In the same article the authors give also the results of their own investigations, embracing thirty-nine cases, together with a resumé of the modern work done on this subject up to the middle of 1905.

Since this time two new investigations have been reported by Arneth[2] and Kjer-Peterson.[3] On account of the great numbers of observations made, the methods used, with perfection and refinement of technique not heretofore employed, these two studies command close attention. They both attempt to bring order into the confusion, which has characterized thus far our conceptions in regard to the leucocytic elements in the blood of tuberculous individuals and anything in this direction is eminently welcome, at a time when we are becoming more

[1] T. J. Ullom and F. A. Craig (H. Phipps Institute): Examination of the Blood in Pulmonary Tuberculosis, with Special Reference to Prognosis, *American Journal of the Medical Sciences*, September, 1905.

[2] J. Arneth: Die Lungenschwindsucht auf Grundlage klinischer und experimenteller hæmatologischer Untersuchungen, Johann Ambrosius Barth, Leipzig, 1905.

[3] R. Kjer-Peterson: Ueber die numerischen Verhaltnisse der Leukocyten bei der Lungentuberculose, Wurzburg, 1906.

and more convinced of the fundamental role of the leucocytes in natural and acquired immunity. During the last winter we have therefore begun with the assistance of Dr. Milton W. Hall a series of systematic investigations,[1] based upon the methods given in these investigations and particularly that of Arneth's.

If we give here a preliminary report on the results without being able to draw definite and exact conclusions, we do so because we feel that in a complex subject like this, involving many laborious examinations, any contribution may prove helpful in future investigations. A more detailed report on this subject will be made in the near future.

Before reporting on our own results we will give a brief review of the investigations mentioned. Kjer-Peterson in the first part of his work, dealing with the normal numerical relations of leucocytes in the blood, after a careful analysis of the literature on the subject, comes to the conclusion that our present-day conception of the subject is based on the results of uncritical and unscientific examinations. His technique for the leucocyte count does not differ essentially from that employed before. He uses the ordinary Thoma-Zeiss chamber without divisions, counting the whole visual field as a unit, according to Thoma's method (quotients to be calculated for each microscope, as has been done for some time in this country), but at an enlargement of seventy only instead of Thoma's two hundred, and always with ocular divisions. For diluting fluid he uses 0.3 per cent. acetic acid solution with methyl violet and counts in dilutions of 1 : 20. By this method he is able to count much more rapidly than with any other, and by an exact determination of sources of error, to which he has given particular and painstaking attention, he believes that he can always obtain accurate and uniform results. The average error in his examinations does not exceed eight per cent., which corresponds to a great degree of accuracy. He does not consider any work exact whose percentage of error is not determined.

If the above method, for details of which I have to refer to the original, is carried out with the precaution referred to, repeated counts become unnecessary, except for the determination of the "homogeneity" of the blood. Drops of blood taken successively from blood, coming from the same puncture, do not always contain the same num-

[1] The investigations were made at the Cook County Hospital for Tuberculosis at Dunning, Illinois and at the Chicago Laboratory. At the former Dr. E. S. Moore, resident physician at the hospital, gave much valuable assistance in the work.

ber of leucocytes per unit volume. Such blood Kjer-Peterson calls "inhomogeneous" and the counting of leucocytes in such cases does not give figures which can be used as the expression for the actual number of leucocytes. "Homogeneity" must therefore be determined before the counting can become of practical value.

With this additional precaution Kjer-Peterson has made numerous counts in healthy individuals. He comes to results which among themselves are quite uniform, but much at variance with those obtained by other observers. This part of his work is of particular interest, since we cannot but be conscious of the uncertainty of our knowledge in this respect, each observer apparently having his own normal standard and using the term "leucocytosis" in conformity therewith. The number of leucocytes in the blood of healthy adults per cmm. as usually given ranges between the widely separated limits of 5,000 and 10,000, with some variation as to the upper and lower limits (Grawitz, Engel, Halla, Rieder, v. Jaksch a. o.). The French observers, however, seem to have adopted a narrower and lower "normal" zone (Hayem, Malassez, Grancher, Bouchut and Dubrisay a. o.). Arneth seems to be the only German observer who restricts the normal range to 5,000 and 6,000, and in this restriction goes even farther than the French school. Kjer-Peterson is at variance with all other observers, in that he maintains that it is impossible to give a definite level for the normal leucocytes curve of both men and women, as they differ essentially. He finds for healthy men a pretty uniform and constant level of the curve between 4,000 to 5,000, with individual differences rarely going above 5,000 and never below 3,500. In healthy women, on the other hand, he finds all figures between 3,000 and 24,000. These figures he obtained from examinations made early in the morning, upon the patient's awakening and before the first meal. He insists on this time as the best for obtaining uniform and comparable results, although he doubts that digestion has any influence at all on the leucocyte curve, while motion and exertion seem to affect the curve decidedly, though only temporarily. Another difference noted between the leucocyte curve of men and women is that the curve of the former shows a straight and constant level, while the course in the latter is given to great variations, the blood therefore showing "inhomogeneity." He comes to his conclusion from his examinations of five men and thirteen women, a small material, as he himself admits, especially in the case of the men,

but he believes this objection to have been overcome by continuing the study of each individual for long periods.

In regard to the subject which particularly interests us, that of pulmonary tuberculosis, his results are based on a carefully analyzed material of one hundred and forty-two men and one hundred and seventy-one women, mostly patients of the Vejlefjord Sanatorium. This certainly must command attention, particularly when we consider the painstaking attention which was given to every detail of technique and the series of single examinations. The author classifies his cases according to the intensity and extent of the pathologic processes in each, and since we have based our own classification upon his we will outline his method here.

Like the one adopted by the National Association for the Study and Prevention of Tuberculosis this classification is based on the one of Turban. The Roman numerals indicate various degrees of the anatomical extension of the process. To these Kjer-Peterson adds further symbols, indicating thereby other characteristics, particularly in regard to the intensity of the process. This has been attempted similarly by Turban and Meissen, but Kjer-Peterson's symbols seem to me to give more clearly a condensed description of a case in regard to its intensity and extent.

Each stage[1] is divided into active (A) and passive (P) cases. He calls active cases those with general constitutional symptoms, which indicate progress of the disease, fever (normal is 98° to 99.7° F. maximum rectal), night-sweats, emaciation or local symptoms as hæmoptysis, and also cases in which history and examination reveal that the local process is more or less in a state of development. Passive cases are those in which the above symptoms are not found.

I. Stage.	*IA*	Active.
	IP	Passive.
II. Stage.	*IIA*	Active.
	IIP	Passive.
III. Stage.	*IIIA*	Disease stationary, or retrogressive.
	$IIIA_1a$	Afebrile case.
	$IIIA_1b$	Occasional temperatures of 100° to 101.3° F. (rectal).
	$IIIA_1c$	One or more periods of temperature above 101° F.
	$IIIA_2$	Advancing though intermittent cases.
	$IIIA_3$	Continuously advancing cases.
	$IIIP_1$	Passive cases with predominating sclerotic processes (stethoscopic finding).
	$IIIP_2$	Passive cases with predominating destructive processes (stethoscope).

[1] (The upper two right lobes or two half lobes are always counted as one.)

The defects of any such classification in its practical application of course is also inherent in this one, especially as the determination of activity or passivity gives great latitude to individual difference of opinion. Kjer-Peterson satisfied the claim for great objectivity, however, by having each case independently classified by a clinical authority and by giving very exact case histories.

With this general subdivision of his material he gives the results of his examinations and tries to establish the possible casual relations between the numerical relations in his cases and the various incidents in the course of the disease. He takes exception to the work of Appelbaum, which is always regarded as authoritative, and calls it "a collection of theories and postulates, without there being presented a single figure to substantiate the theses." On the other hand, the results of his examinations of the whole coincide more with those of Stein and Erbmann,[1] who came to the following conclusions:

1. Increase of leucocytes in tubercular individuals, if there is not present a chronic, prevalent or exudative, inflammatory process, speaks for cavity formation in the lung, a view held in this country for years by Cabot.

2. The beginning of cavity formation in a case can be determined by consecutive counts of the leucocytes and by a sudden increase in their number after a prolonged normal period.

3. Cavity formation can be excluded in most cases if normal numerical conditions are found. The cause for the increase of the leucocytes is not in the tuberculous virus as such, but is a consequence of septicæmia, caused by certain highly virulent bacteria, not by what is usually understood by the term mixed infection, which cannot with certainty be excluded in any form of tuberculosis.

Kjer-Peterson finds no distinct relationship between the local extent of the changes in the lung and the leucocyte count, both in men and women. The level of the curve seems to be the lower the more passive the process. In active cases in women, however, he sometimes has found low values. He finds no constant relation between variations in temperature and the number of leucocytes, and in rapidly progressing cases of the third stage he finds leucocyte curves of either very high or very low level. With a single exception he found that high leucocyte counts were met in cases with very bad prognosis or in which

[1] Stein and Erbmann: Zur Frage der Leukocytose bei tuberculosei Processen, *Deutsches Archiv. f. klin. Med.*, LVI.

there were other complications (tumor, fetid bronchitis, etc.). Contrary to usual opinion, therapeutic measures, which would induce decrease rather than increase of leucocytes in the capillary blood, would recommend themselves in such cases.

In this work no attempt is made by its author to differentiate the varieties of white cells. In regard to the results of recent investigations in this field we find again a great and confusing divergence in the reports presented. Responsible for this chaotic condition are principally lack of uniformity in classification of the leucocytes and also of the cases in regard to the stage of the disease. Anything that will promote uniformity in these matters will materially help us to a better understanding of the morbid processes under consideration.

In our counts we have not been able to adopt all the precautions recommended by Kjer-Peterson, his monograph having appeared so recently. Therefore the figures which we obtained and which are given in the tables cannot be compared directly with those obtained by him. They are, however, comparable among themselves and with the results obtained by differential methods of cellular analyses. A more extensive reference to Kjer-Peterson's methods and findings is made here, because in our future studies of the numerical leucocyte relations they shall be based on his technique and also because it is hoped that other investigations may be made which will allow comparison. All our counts were made four to five hours after the first meal, but no attempt made to determine the "homogeneity" of the blood. The results of our counts, which are tabulated together with other findings, will be discussed later.

We do not need to enter here into a review of the rather voluminous literature which has accumulated in recent years. It is analyzed by Ullom and Craig in the article referred to. Here a brief reference is also made to the work of Holmes and Arneth, treating both as identical lines of investigation, which they are only to a very limited degree.

That a differential examination and count of the white cells is necessary in order to determine whether an increase of leucocytes can properly be considered as a "leucocytosis" has occasionally been insisted on. Da Costa[1] for instance understands by the term "leucocytosis" an increase of the polynuclear neutrophile white cells. Strauss and Rohnstein[2] observed in chronic pulmonary tuberculosis the fol-

[1] Da Costa: "Clinical Hematology," London, 1902.

[2] H. Strauss and R. Rohnstein: "Die Blutzusammensetzung bei den verschiedenen Anæmien," Hirschwald, Berlin, 1901.

lowing average percentages: Multinuclear, 80.8 per cent.; mononuclear, 17.2 per cent.; lymphocytes, 13.1 per cent.; they are impressed by the fact that with progressing disease there is a tendency of decrease of the mononuclear percentages. R. Cabot finds little qualitative changes in many cases; sometimes he has noted with a normal leucocyte count an increase of the lymphocytes and large mononuclears. With an increase of the total leucocytes he observed the ordinary marked increase of the polymorphonuclears at the expense of the lymphocytes. The eosinophiles he has seen increased in some cases with cavities, but he does not consider this fact of any particular importance, as done by others. Another American observer, Swan, notes in the second and third stage polynuclear leucocytosis increase of the eosinophiles, a fact which he considers prognostically favorable.

Holmes[1] has studied the morphology of the white cells in the blood of tuberculous patients. He believes that tissue destruction goes parallel with disintegration of the white cells and that the degree of regenerative power can be estimated by the intensity of the nuclear stain, the number of intact nuclei, the relatively high percentage of young cells and the increase of eosinophiles.

Arneth[2] has in an exhaustive monograph described his method, technique and results of finer morphologic and particularly nuclear studies of neutrophiles in infectious diseases, including tuberculosis. In the work above referred to he gives a resumé of all his investigations in this latter disease. The neutrophiles on account of their predominant numbers (75 to 100 per cent.) among the total of all leucocytes, must play, according to him, a most important role in the organism. He divides the neutrophiles into five classes. His class I contains mononuclear neutrophiles, Class II neutrophiles with two nuclei or particles of nuclei, Class III three and so on. He makes furthermore subdivisions according to the shape and number of the nuclear subdivisions. A neutrophile of Class I with an absolutely round nucleus he designates as myclocyte (M.). The other forms in this class with more or less indented nuclei, which he thinks correspond to the polymorphonuclears of other authors, he calls in accordance with the degree of indentation, W. (wenig) for slight, T. (tief) for deep indentations.

[1] A. M. Holmes: "The Diagnosis of Tuberculosis from the Morphology of the Blood," *Medical Record*, 1896, and other articles.

[2] J. Arneth: "Die neutrophilen weissen Blut-Korperchen bei Infections Krankheiten," Gustav Fischer, Jena, 1904.

[3] In our tables we have adopted the symbols Sl. and D., according tc the English nomenclature.

In other classes he notes whether there are nuclei in the shape of loops (S-Schlinge), or round nuclear particles (K-runder Kernteil).[1] He examines the dried blood film, stained with Ehrlich's triacid solution, and always determines in each case the total number of leucocytes. By always counting one hundred cells his figures indicate the procentual relations of the various groups. The various combinations of loop and round nuclei in the neutrophiles and the three groups in Class I give a total of twenty subdivisions of his original five classes. This seems at first very complex but after some experience one learns to classify rapidly the cells according to their respective subdivisions, provided one has a well stained specimen.

By inscribing the numbers found into tables horizontally one next to the other beginning with Class I at the left end, he receives what he calls a neutrophile "blood picture." From an average of fifteen single examinations of healthy adults he determines his standard normal neutrophile blood picture, which we shall give later. He finds this picture altered in pathologic conditions though not parallel with the changes in the total number of leucocytes. He can find a profound alteration of the blood picture with a perfectly normal (5,000–6,000) leucocyte count. His tables give a very clear demonstration of these conditions. Thus he finds it necessary to distinguish different kinds of "cytoses" (abbreviation for leucocytoses): "hyper," "normo" and "hypocytoses," indicating increased, normal and decreased number of leucocytes; and as regards the blood picture he then distinguished isocytoses and anisocytoses, *i. e.*, those with normal and altered blood picture. Since, as we have seen, the numerical findings of the leucocytes do not correspond with the alterations of the blood picture, in order to designate these relations he speaks of anisohypercytoses, isonormocytoses, anisonormocytoses and anisohypocytoses. The terms here enumerated designate the relations most frequently encountered.

The cells with the more complex nucleus (higher classes) Arneth thinks are the riper and more efficient ones, while the others are the youthful and therefore less efficient types (contrary to Holmes). The pathological alteration of the blood picture is characterized by the disappearance or decrease of the cells from one class and the appearance or increase of cells in another, one can then speak of a shifting of the blood picture to the left or right. By a great number of examinations of the blood picture in infectious diseases and also in experimental

[1] In our tables marked as L. and R.

infections and intoxications of rabbits Arneth has been able to demonstrate a constant and direct relation between the course of the disease and the relations of the picture. The latter are therefore an index of the defensive and protective efforts of the body against infections.

Before recording the results of examinations made by ourselves we will try to illustrate by typical blood pictures of his and also by some of our own taken at random from our records. In the tables below we have for the sake of simplicity avoided giving the results of the counts in the lesser subdivisions. Though they have all been made in each case, the sum for each principal class is here given. In a more detailed later report we shall give all the divisions.

1. *Arneth's normal (average of 15 examinations) neutrophile blood picture. Isonormocytosis.*

	I	II	III	IV	V
Actual leucocyte count, 5,500..	5%	35%	41%	17%	2%

Picture one illustrates a normal distribution of various neutrophile cell types; we see that the types of the classes III and II predominate, with a fair percentage of cells of class IV. In the picture (2) of a

2. *Miliary tuberculosis (Arneth's case 1, 9/1/04 Anisohypocytosis.*

	I	II	III	IV	V
Actual leucocyte count, 4,400..	36%	56%	8%		

case of acute miliary tuberculosis (patient died nine days later) which is one of successive examinations, we can observe the typical "shifting" of the picture to the left, practically all the cells are crowded into the first two classes. Only the more youthful elements are left to carry on the struggle and this condition increases with the progress of the case. The total leucocyte count is low. Similar conditions we find in the third picture, which, however, is not taken as in the last case from an early series of examinations, but from the last of the series shortly before the death of the patient. It shows the last phase

3. *Subacute (not miliary) tuberculosis (Arneth's case 5, 10/2/03 Anisohypercytosis).*

	I	II	III	IV	V
Actual leucocyte count, 8,400..	45%	52%	3%		

of continued alteration of the blood picture, with slight hyperleucocytosis.

Picture four is derived from one of our few cases which do not show

4. *Chronic pulmonary tuberculosis stage IA (case 5(34) Anisohypercytosis.*

	I	II	III	IV	V
Actual leucocyte count, 7,600..	14%	37.5%	36%	11%	1%

extensive alterations. It is also one of those cases which are very difficult to classify as regards activity or passivity. There is very slight fever only occasionally, rarely reaching above 100°. A further alteration in the blood picture, observed later, should make the prognosis more unfavorable than a general clinical consideration of the case would allow.

Picture five shows a slightly more marked alteration, especially in

5. *Chronic pulmonary tuberculosis stage IP (case 8(37) Anisonormocytosis.*

	I	II	III	IV	V
Actual leucocyte count, 5,800..	2.5%	51%	38.5%	8%	

Class II. Diagnosis is made from results of physical examination, not verified by microscope. The patient lost in weight very considerably. By no means a clear case, the low percentage in Class I is remarkable and may perhaps have diagnostic significance, together with the number of leucocytes.

Picture six from a case with farther extended pulmonary lesions and signs pointing to considerable activity of the process. The number of

6. *Chronic pulmonary tuberculosis stage IIA (case 24(52) Anisohypercytosis.*

	I	II	III	IV	V
Actual leucocyte count, 7,600..	14%	56.5%	24.5%	4.5%	0.5%

leucocytes is only slightly increased, while the blood picture is markedly shifted to the left. Prognostically from every view point a bad case, though not nearly as extended in regard to the pulmonary lesions as the two following cases.

Pictures seven and eight were obtained from far advanced cases with

7. *Chronic pulmonary tuberculosis stage IIIA (3) case 30(59) Anisohypercytosis.*

	I	II	III	IV	V
Actual leucocyte count, 8,400..	55%	38.5%	5.5%	0.5%	0.5%

8. *Chronic pulmonary tuberculosis stage IIIP (1) (case 26(54) Anisohypercytosis.*

	I	II	III	IV	V
Actual leucocyte count, 27,080..	29.5%	60%	9%	1.5%	

extensive pulmonary lesions. The principal difference in the two blood pictures seems to be in the first two classes and in the leucocyte count. The last case is interesting for the fact that in spite of very advanced lesions, there has been gain in weight although the blood picture deteriorated.

As regards the "normal neutrophile blood picture" series of exami-

nations have shown us[1] similar relations to those obtained by Arneth in healthy individuals. The examinations were made at different times of the day in specimens of blood from six individuals and objectivity of judgment was insured by independent counts and subsequent comparison of results. A distinct uniformity of results was quite striking, the ratios of distribution of the five principal types of cells being quite constant. We can therefore thus far confirm this part of Arneth's results, contrary to Flesch and Schlossberger,[2] who on examination of twenty-six normal individuals, mostly children, found a very different numerical distribution of the cells in the five classes. They, however, recognize also a fairly uniform "normal" picture.

Further serial examinations of neutrophile pictures of healthy individuals of both sexes and at various age periods and under different external influences seem most desirable, and we have planned such investigation on a larger scale. The technique of the method is quite simple, particular attention is necessary to insure thin blood smears. Undue pressure in the spreading of the blood on the cover glass can directly or indirectly lead to a distortion of the cells and so artificially modify the picture. That the spreading, drying, fixing and staining of the blood has a direct influence on the shape of the nuclei is forcibly suggested by the photographs recently obtained by means of the ultra-violet light (Ernst, Grawitz) of polymorphonuclear leucocytes not previously prepared. In these the nuclei do not seem to have the complex conformation seen in the stained specimens. Further improvement in the technique of ultra-violet photography, however, is necessary before pictures obtained by it can be compared with the stained specimens. The stain used by Arneth is the tri-acid solution of Ehrlich, not a good nuclear stain, a fact which he thinks is rather of advantage, because it avoids too great detail in the nucleus. In our examinations various stains have been tried and we found that for proper differentiation of nuclear forms the tri-acid solution gave very unsatisfactory results. For this reason Wright's stain has been employed in most instances with better result. At least one hundred cells have been counted at each examination and in different specimens. The accurate and minute classification of the cells constitutes the principal

[1] Reported at a meeting of the Chicago Pathological Society in April, 1906, by Drs. Hall and H. Klebs.

[2] Flesch and Schlossberger: "Die Veraenderungen des neutrophilen Blutbildes," *Jahrbuch f. Kinderheilkunde*, 1905.

difficulty of the method. The proper distribution of the cells, however, into the principal classes is not so difficult and for practical clinical purposes this probably suffices.

The uniformity, which the normal blood pictures maintains with varying total leucocyte figures, impressed us particularly.

The blood pictures shown above as examples on the whole confirm Arneth's observations. All of them except four and five show marked alterations. A material so uniformly bad as ours does not permit far-reaching conclusions as regards prognosis. An interpretation of the finer changes in our blood pictures is quite difficult and ought to be made with caution, and it will need many further examinations and technical improvements to make the method more serviceable. In the following table we have arranged the cases according to the alteration of the neutrophile picture which they presented, beginning with those in which the alteration was slightest. This arrangement is not absolutely correct, because it is based upon the sum of cells found in the first two classes only. A variation between these two classes, as frequently observed and perhaps of considerable importance is therefore not taken into account in this arrangement. It seemed to me, however, of advantage to range the cases by some approximate method for purposes of a general survey.

If we compare the figures in the two columns of the neutrophile pictures and the total leucocyte count we find with increasingly damaged blood pictures every degree of normo-cytoses or hypercytoses. On the whole, however, there appear with increasing alterations of the blood pictures also the higher numbers of leucocytes. The exceptions are quite evident, but an interpretation of the discrepancies is very difficult. Several of our figures were obtained from single observations only and since variations occur we probably should have had to modify them after frequent repetitions of the examinations. In studying the table this defect must be considered.

Examples of cases with a damaged blood picture but with normal or nearly normal leucocyte numbers we find in cases (serial nos.) 13, 14, 15, 17, 18, 19, 21, 27, 28, 31. They are all prognostically very unfavorable cases. Arneth thinks that the particularly unfavorable aspect of these cases is due to the disproportion existing between the production of young and the destruction of older cells. The young cells are just sufficient in number to counterbalance the loss of older cells without being able to fill the deficit. If hypercytotic figures are reached

Serial No.	Case No.	I–II.	Leucocyte Counts.	Stage.	Sex and Age.	Remarks.
1	28 (56)	41	17000	II A	M. 42	
2	5 (34)	51	7300	I A	F. 21	Operat. f. append. retrovers. Pleurisy. Lymphocytes above norm.
3	7 (36)	52	4350	III A3	M. 77	Emphysema. Tabes dors. Died day after.
4	8 (37)	54	5800	I P	F. 27	Asthma bronch. no tbc. incr. of Eosinophiles (7 per cent.).
5	29 (58)	55	9800	III P1	M. 51	Thrombus of r. brachial.
6	27 (55)	59	7900	III A3	M. 35	Unconscious, died in night.
7	22 (50)	64	9200	III A3	M. 40	Unconscious, dying.
8	10 (38) (a)	66	5500 12000	I P	M. 29	Scoliosis, gain in weight, well nourished, drinker.
9	25 (53)	67	12600 12200	III A1b	M. 27	Large cavity, abund. sputum.
10	24 (52)	71	7600	II A	F. 29	Epileptic.
11	20 (48)	73	14200	III A1b	M. 26	Marked pleurisy.
12	16 (44)	74	15970	III A3	M. 36	Cavity, abund. sputum.
13	18 (46)	75	7100	III A1b	M. 55	Cavity.
14	31 (60)	75	7600	III P1	M. 48	V. chron. type, 20 yrs.? able to work.
15	4 (33)	75	9000	III A3	M. 30	Acute nephritis, syphilis, small loss in weight, drinker.
16	13 (41)	76	10400	III A1b	M. 27	Abundant sputum, losing in weight.
17	15 (43)	76	9200 8640	III A2	M. 42	Mitral regurg. large cavity, ab. sput. drinker.
18	11 (39)	79	5230 13800 9400	III A2	M. 48	Susp. cavity, hæmoptysis. Lymphocytosis.
19	19 (47)	80	7560		M. 26	
20	23 (51)	81	16400	II P		
21	32 (61)	82	5000	III A3	M. 21	Large cavity, hæmoptysis, lymphoc. norm.
22	12 (40)	83	17000	III A3	M. 40	Cavity profuse hæmopt., syphilis, lymphocytosis (losing).
23	3 (32)	83	17321 12400 19000 18400	III A3	M. 32	Large cavity, large quant. sputum, num. tbc., drunkard. Rapidly losing in weight.
24	1 (30)	83	9700 10200 10110 11160 8800 9000	III A2	M. 42	Cavity pneumo-thorax? hæmoptysis. Abundant sputum.
25	6 (35)	87	10555 13500 17200	III A2	F. 18	Cavity, moderate quant. sput. Lymphocytosis.
26	9 (38)	87	11000	III A3	M. 33	Rapid decline.
27	17 (45)	88	6940 7600	III A3	F. 47	Gen. firm, œdema. Died in eve.
28	14 (42)	90	3300 6770	III A3	M. 38	Dying.
29	26 (54)	90	32800 27080	III P1	M. 21	Scoliosis tb. coxalgia. Cavity, gain in weight.
30	21 (49)	91	13500	III A2	M. 26	Lymphocytes markedly subnormal.
31	30 (59)	94	8400	III A3	M. 50	Large cavity, great emaciation, delirious.
32	2 (31)	95	8950 11120 12200	II A	M. 16	Tb. peritonitis, fecal fistula, splenic tumor.

the deficit can be supplied and the prognosis becomes better. That this does not always bring about an improvement of the picture and the condition of the patient, the greater number of our cases demonstrates.[1]

The more or less profound alteration of the neutrophile picture which we have observed in all the severe cases of tuberculosis, with only very few exceptions, seems in general to confirm Arneth's statements. Prognostically valuable conclusions we could not draw from the condition of blood pictures, which in itself is of no particular significance considering the preponderant majority of far advanced cases. Examinations of first and second stage cases, which we have begun, will throw further light on the question, also that of cases treated with tuberculin. The method would certainly have the advantage of simplicity over others, particularly that of determination of the opsonic index and for that reason alone further investigations on these lines seem desirable. This preliminary report is intended to induce such.

DISCUSSION ON DR. KLEBS'S PAPER

Dr. William Krauss, Memphis: I have been much interested in Dr. Klebs's paper because it is along the lines in which I have done some work. No one can appreciate the full meaning of the paper unless he has studied the original monograph of Arneth. I studied it very carefully and applied it to cases of malarial fever, yellow fever, typhoid fever and tuberculosis. Unfortunately, in a general hospital our cases are advanced cases and I soon found it impossible to draw any comparison on account of the great variety of complications. I found that as far as I was able to follow the principle it tended to confirm the general opinion of the case rather than to throw any light upon it. On the other hand, in the general infections the principle comes out very distinctly, but here we have other clinical data that are quite clear, so that it doesn't add much in these cases. We could see that the shifting in the picture was very distinct in cases of more or less gravity.[2] There is probably more in the principle than we are at present able to utilize. I agree with the doctor as to the technique in some respects.

[1] An interesting feature in our material is the fact that there are several cases with both tuberculous and syphilitic lesions. In how far this fact can affect the blood picture cannot be surmised from the small number observed.

[2] Arneth calls attention to the fact that in pneumonia the leucocyte balance is not restored until long after the immunizing balance and the normal count has been reached. Possibly the same can be shown in apparent cures from tuberculosis.

I am convinced that the leucocyte count per cubic millimeter is more nearly between five and six thousand. So many men who have written with more or less authority have paid no attention to outside factors, as exercise, digestion, etc., which must be considered. I prefer the low power with high dilutions instead of the high power with low dilutions. We had considerable difficulty with stains. The Wright stain soon loses its basic properties. I am now using a modification which is satisfactory. In making up the solution in methyl alcohol, according to Wright, I alkalinize it with 1 per 10,000 carbonate of potassium and add ten per cent absolute alcohol. It doesn't change for months and gives quite reliable results. The grade of wood alcohol has much to do with the success of the stain.

Major Geo. E. Bushnell, Fort Bayard, N. M.: We have probably examined the blood of a larger number of patients by the Arneth method than any other sanatorium in the United States and I have been impressed with the almost exact coincidence of our results with those claimed by Arneth. The method would appear to be of probable value in relation to prognosis, and particularly to determine the question as to whether the patient who appears to be cured is really cured. We have examined a number of cases which were apparently cured. In some cases the blood count was found to be normal, in others not. I remember especially four sailors who were reported by an examining board as fit for duty. In three of these cases the blood was found to be normal by the Arneth method, in the fourth the count was not normal. We shall follow this fourth case with especial interest in order to determine the relative reliability of the clinical and of the hæmotological examinations. There is no doubt that the blood picture is much later in reaching the normal than the clinical picture. If we can determine by the blood count that the patient is actually cured it will be a decided gain. I look forward to a combination of this method with the opsonic method. Of course the whole matter is still in its infancy and long experience will be required before we can decide as to the reliability of the tests.

Dr. Arnold C. Klebs, Chicago: I have been much interested in Major Bushnell's remarks and hope there will be a publication forthcoming from him so that we can compare results. I think there is something in this matter and that it is much simpler than the "Opsonic Index" method. If we get more of these tables so that we can compare the results I think it will prove one of the most valuable methods.

ON THE USE AND ABUSE OF PULMONARY GYMNASTICS IN THE TREATMENT OF TUBERCULOSIS

By Charles L. Minor, M.D.

Asheville, N. C.

In no profession is there a greater need than in medicine to guard, on the one hand, against the unreasoning acceptance of methods in general use without proper investigation, or, on the other, against adopting too quickly those based on attractive but ill-founded theories.

The swing of the pendulum of therapeutic practice is unceasing. On the one hand, the tendency to follow the latest fashion is as evident as it is unfortunate; on the other, the inertia that would unquestioningly accept without investigation old methods of practice, thus stopping all advance, is always at work and is even more dangerous; hence the doctor must never forget the wise motto "Prove everything." However cautious he should be not to be carried off his feet by admiration of the new just because it is new and not because he has proven it true. an occasional reëxamination of the old, of the theoretical and clinical bases of our former faith and practice, is unquestionably wise; hence when your chairman asked me to write on the use and abuse of pulmonary gymnastics in tuberculosis I gladly complied. Such gymnastics have formed a part of the treatment of the disease to a greater or less extent since the earliest times; they have been approved of by the majority of phthisio-therapeutists when carefully used, although since Cornet wrote in '98 his work on Tuberculosis, in which he opposed them, some have followed in his lead.

Such gymnastics have not lacked for scientific foundation, the work of Waldenburg[1] and, more recently, of LeGrange,[2] Lazarus,[3] Campbell[4] and Tissier[5] being thoroughly scientific and very well known.

[1] Waldenburg, Pneumatische Behandlung, Berlin.
[2] LeGrange, "Medication par l'exercise," Paris.
[3] Lazarus, "Pneumatotherapie"; Eulenberg, Samuel's Lehrbuch Allg. Therap.
[4] Campbell, "Respiratory Gymnastics," London.
[5] Tissier, Article Pulm. Gym.; Cohen's Handbook Phys. Therapeut., New York.

Let me here state that my own position regarding the matter is that in properly selected cases, and when properly used, such gymnastics are of great value and that any doubt of their utility is founded upon the all too common abuse of them by those who have used them indiscriminately, thoughtlessly and unintelligently.

In this country the most pronounced advocate of the views of Cornet has been Dr. Bridge of Los Angeles, who has opposed their use as always harmful and advocated in their place immobilization of the chest by adhesive or other bandages. In view of the publication of such views it is desirable that we should consider the objections that have been raised, fairly and carefully, to see if the practice of the profession in this matter in the past has been wise and based on reasonable grounds, and since Dr. Bridge echoes the views of Cornet and goes considerably further than he in his opposition to gymnastics, I will turn my attention to a consideration of the views on the matter which he has expressed in his book "Tuberculosis," published in 1903. These views I can express correctly as follows, using altogether his own words: "The wise and useful practice of the profession in treating all varieties of tuberculosis, except that of the lungs, has been to put the part at rest so far as possible. Just the opposite course has obtained in managing the lungs. The almost uniform practice has been, as soon as these organs become tuberculous, to urge the patient to take repeated deep breaths and 'expand the lungs.' . . . All these methods are harmful and wrong. There is no proof that the lung is an exception to the rule that tuberculous organs do best when perfectly quiescent; and there is much evidence to the contrary. The diseased lung needs to be put at rest so far as it can be . . . and no tuberculous lung should ever be allowed to expand and grow larger. Even cough should be suppressed whenever possible, in order to avoid the stretching and injury to the diseased tissues. One of the results of violence to an ulcer on the surface of the body is to increase the amount of scar tissue. . . . The tuberculous lung heals, if at all, with more or less new connective tissue around and in the midst of the diseased area. The process is presumably conservative; but if too much fibrosis occurs the contraction cripples the lung and may itself destroy life. . . . The great desideratum is to have as little fibrosis as possible consistent with cure. . . . There can be little doubt that other things being equal, the amount of fibrosis bears some proportion to the measure of violence or motion to which the lung tissue has been subjected during the dis-

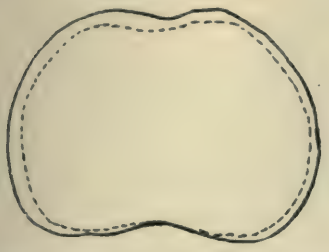
ease. If this is true, it is our duty to minimize or abolish the motion of the diseased lung." These words, quoted verbatim, represent the views of Dr. Bridge. If these views are correct, they would, of course, call for an entire giving up of all thoracic motion on the diseased side, including all bodily motion, as it has long since been scientifically proven that all muscular exertion increases and deepens respiratory motion. But I believe, on the contrary, that they are in conflict with reason and with clinical experience, which teaches not only that the thorax in tuberculosis tends to shrink as the case does badly and the trouble spreads, but that in all incipient cases tends to re-expand as the case improves and the lung re-opens, atelectatic areas open up again and air reaches the lung more freely and fully.[1] It is, moreover, generally conceded that the atelectatic areas around tubercular foci are especially prone to fall a prey to the disease; hence gymnastics which undeniably will remove or prevent such collapse of the alveoli seem both rational and necessary. This opinion is not merely the result of general impressions but of a careful study of carefully kept lead tape tracings and spirometric readings as well as of records of the shrinkage and expansion of apical outlines and of fluoroscopic observations of this same shrinkage and re-expansion which I have taken systematically now for a number of years on many cases, at monthly or longer intervals, and which have given me the absolutely positive evidence of the correctness of the statement which I here make, and I am satisfied that any one taking the pains to make and record such findings will, whatever the preconceptions with which he starts, be convinced of the correctness of this view. I would refer to a few such tracings which I exhibit. To anybody interested in the matter I can show large numbers of such tracing records in all varieties of cases. The favoring effect on the development of tuberculosis of occupations that narrow the thorax and limit respiratory motion, or of scars which bind the chest down, is universally recognized, the narrow contracted chests of those prone to develop the disease are a matter of daily experience and the beneficial effect on the health of such people of gymnastics which tend to expand the thorax need hardly be dwelt upon. It will scarcely be denied that it is wise in those with badly built chests, but

[1] In advanced cases with much destruction of tissue as they improve fibrosis occurs and hence in such cases improvement is followed by a marked shrinkage but as will be shown later such advanced cases are rarely if ever suitable for gymnastics.

CLINICAL SECTION

All tracings were taken on a plane cutting the junction of fourth rib and sternum in front and the eighth dorsal spine behind.

The first six show the practically uniform coincidence of thoracic expansion with improvement of case, the second six the failure of gain or decrease of expansion in stationary or retrograding cases. Dotted line earlier tracing; black line later tracing.



March, '06–May, '06. Very incipient case; improving. Gymnastics used. Gain and coincident expansion.

December, '05–February, '06. Slight right apex catarrh; improving. Gymnastics used. Vital capacity increasing. Motion at bases increasing.

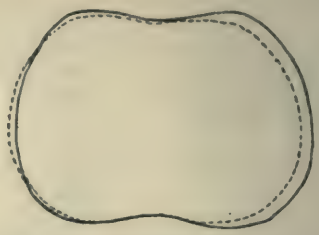
January, '06–March, '06. Incipient case of moderate intensity in right upper one-third. Going on to probable cure. Gymnastics faithfully used. Vital capacity and motion of bases increasing.

December, '05–April, '06. Incipient case at right apex. Gain in vital capacity and slight gain in motion at base. Gymnastics freely used.

December, '05–May, '06. Moderate bilateral process, especially right, making excellent gains. Right side bound down by scar of extensive breast amputation. Vital capacity not taken. Motion at bases gaining. Deep breathing used.

December, '05–March, '06. Active case with bilateral involvement after left sided pneumonia and nephritis. Great improvement—probable recovery. Motion at bases gaining. Gymnastics used spasmodically.

February, '06–March, '06. Sluggish incipient case. Right upper one-third. Slow gains. Final outlook probably good. No material expansion. Motion left base increasing, right base unchanged. Vital capacity unchanged. Gymnastics ordered but intermittently used.



September, '05–April, '06. Old right sided process now doing well. Lately extension on left. Progress of case sluggish. Gain on right side as it improved, loss on left as it became involved. Gymnastics at first used, now stopped.

October, '05–April, '06. Chronic case, improving greatly after severe onset. Much right-sided fibrosis. Marked retraction right apex and base; slight signs on left. Distortion of fibroid side, slight expansion on left. Only quiet deep breathing used.

September, '05–May, '06. Old chronic ulceration case with some fibrosis, capable of amelioration but not of cure. Shrinking. Gymnastics never used.

January, '06–May, '06. Extensive and slowly improving. Active process left upper half and right apex. Patient slowly gaining but prognosis dubious. Motion of bases limited. No material change; no gymnastics.

October, '05–March, '06. Unfavorable bilateral case slowly spreading. Slight contraction of thorax and clinically retrogression. No gymnastics.

not being tubercular, to develop the thorax and lungs to their fullest, to decrease the likelihood of tuberculosis developing in them. If so, it can scarcely be wise in a lung which contains a tubercular area of moderate extent to limit the motion of the enormously larger area of healthy tissue, to decrease its functioning by bandages or strapping, to favor rather than remove the peripheral atelectasis I have referred to in order to immobilize as far as possible the diseased area. Further, if we have learned one thing as to tuberculosis it is that nourishment of the cell to strengthen it in its fight against the bacillus is essential (and I think we doctors too often forget that the oxygen of the air we breathe in, and which is absorbed by the blood in the lungs, is just as much nourishment or food as is the chyle in the intestines which is carried by the lymphatics to be emptied into the same blood current and fed to the same cells). Then why just at the time when the body most needs nourishment should we cut down hæmatosis, dam back carbon dioxide into the cells and lessen oxygen intake?

He who has watched tuberculous cases knows that returning health is marked by returning color in the pale cheeks, showing such an increased hæmatosis, by more erect shoulders, a more expanded chest, deeper breathing, increased vital capacity. And what doctor will believe that such a patient can possibly be injuring himself by a measure which tends to produce just such results?

If opening up an occluded nose which, as ample experience has shown me, can, by deepening breath and increasing oxygenation be beneficial to the patient's general health, and nutrition and color, why are not also gymnastics which increase the amount of oxygen reaching the lungs and thence the cells, those final factors in a fight against the disease, reasonable and wise? As Robin well says:[1] "It is logical to think that the lessening of the area of hæmatosis is especially prejudicial to the consumptive in hastening that organic deterioration which is brought about by tuberculosis." LeGrange[1] notes that no organ modifies itself so rapidly as does the lung to accommodate itself to more or less heavy demands upon it. Tissier[2] in the same way dwells upon the fact that large amounts of lung tissue are only called into use when special demand is put upon the lung, and that by gymnastics we can call into play to reinforce the strength of the body much

[1] Robin, Traité de Therapeutique, Paris.
[1] *Loc. cit.*
[2] *Loc. cit.*

larger areas of lung than are generally employed. As I have already said, lead tape tracings show conclusively that in incipient cases increase or decrease of thoracic perimeter goes uniformly with improvement or retrogression of the case, and to a less degree the same is true of vital capacity. Local shrinkages can and do indeed take place, chiefly over the apex, until or unless compensated by emphysema, or in the sterno-clavicular angle, but the affected lung as a whole, and the unaffected lung also and earlier, undergo very marked enlargement if the case is progressing favorably. All those who have watched such cases in localities of moderate or great altitudes have noted the enlargement of the thorax which the involuntary deep breathing and gymnastics produced by these altitudes bring about, and I believe will bear me out in the statement I have made that in incipient cases expansion means gain, general shrinkage loss.

In more advanced cases, and especially where there is cavity formation or much destruction of tissue, there is and necessarily must be shrinkage of the bad side, not primarily due, as the doctor implies, to fibrosis, but to caseous destruction of lung tissue which necessitates a falling in of the thorax to compensate for it and which is accentuated later in favorable cases by fibrosis. Thus I think that Cornet's view that the diseased lung should be put at rest does not stand the test of clinical experience and that it can only apply to lungs extensively infiltrated or considerably broken down, and that where, as is usually the case in favorable cases, a majority of healthy tissue exists it is bad practice to advise immobilization. Again, Dr. Bridge dwells upon the harmful effect of violence to an ulcer causing more fibrosis.

The fibrosis that occurs in phthisis is the result of the reaction of a strong and combative organism against the tubercular poison and is one of the very best evidences of that strength of constitution which will enable the cell to conquer. The weak cell, like the weak man, in the face of irritation degenerates, caseates, dies; the strong cell, like the strong man, is stimulated by the same irritation, to further effort against its enemy, changes from a simple lymphoid cell to a connective tissue cell and builds a wall of scar around the tubercle. This is fibrosis and it is rarely if ever the harmful process the doctor would make out. In a small percentage of cases it favors bronchiectases and can be harmful, but in the vast majority it is a beneficial process, Nature's own method of cure, and the clinician soon learns to welcome with pleasure every evidence of its commencement and progress. It

is not primarily or chiefly caused by physical violence, but is the specific reaction of the cell to the tubercular poison and the assumption that it is unduly increased by motion in the lung and that the amount of fibrosis bears some proportion to the measure of violence or motion to which the lung has been subjected during the disease would I think be most difficult to prove, and if proven would not make a valid objection to gymnastics, since fibrosis, as I have said, is so generally a beneficial process.

Thus it seems to me that both reason and clinical experience are against those who would discard gymnastics and especially those who would substitute for it immobilization.

However, while I believe that this is the correct view, there is no question that pulmonary gymnastics both in medical circles and especially outside them by physical healers and quacks has been used irrationally and without a proper and careful selection of cases and that as a result it has often done great harm. This, however, is true of every therapeutic measure; whatever the procedure, some will always misunderstand its principles, ignore its contraindications, misapply its use. Every drug in the Pharmacopœia, every hygienic measure has been and is being so abused, but this, which is an old and sadly justified complaint in our profession, demands not a giving up of useful though misused methods, but a careful study of their indications and contra-indications, an understanding, as my title implies, of their use as well as their abuse.

Pulmonary gymnastics are such motions or exercises as tend to increase the size and improve the shape of the thorax and of the lungs within and their final aim is to increase the resistance of the lung against the advance of the disease and to increase oxygen intake and carbonic acid output, effecting thus nutrition through the systemic as well as the pulmonary respiration and the circulation of the blood in the thorax, which as Waldenburg[1] has long since shown is powerfully affected by respiratory gymnastics. It should be noted that any bodily exercise produces the same effect as pulmonary gymnastics in a less degree, deepening and slowly breathing, increasing oxygen intake and carbonic acid output, as also does residence in altitudes, but I shall of course confine myself purely to pulmonary gymnastics, noting only that if in tuberculosis pulmonary motion ought to be cut down to its lowest possible figure, tuberculous cases must all be kept at absolute

[1] *Loc. cit.*

bodily rest flat on their backs at the lowest possible levels, as only thus can the minimum of lung motion be attained. Pulmonary gymnastics can be classed as follows: (I) Prophylactic; (II) Curative.

I. *Prophylactic.*—(*a*) In childhood when on account of a bad heredity or for other reasons the maximum development of lung capacity is called for. (*b*) In badly shaped chests, to restore or improve their shape. (*c*) After sicknesses that tend to limit pulmonary capacity, as after pneumonias with slow resolution, or in pleurisy.

The prophylactic use of gymnastics I believe none will object to in either of its three sub-heads. Here it is that the family doctor can do so much and often does so little for the children under his care, by carefully inspecting their chests at yearly intervals and instituting such proper movements as will tend to correct the very frequent deformities of the thorax resulting from rickets, whooping cough and other causes. Every man who treats tuberculosis has had, I am sure, ample occasion to wish that this had been done to his patients while they were children and the thorax still soft and yielding. Again, in those with the habitus phthisicus or with badly built chests, but no signs of tuberculosis, their flat chests can be wonderfully deepened, the marks of past rickets to some degree removed, and vital capacity and expansion greatly increased; also after pleurisies and slowly resolving pneumonias they are universally recognized as invaluable in redeveloping the lung and decreasing the chance of the incidence of tuberculosis in the future. And here I may be pardoned for urging all medical men to familiarize themselves with the use of the lead tape, cyrtometer and callipers, whose use is not difficult to learn and which will greatly aid the eye in recognizing thoracic malformations and in showing increase or decrease of thoracic expansion.

II. *Curative.*—Their curative use can be considered under the following heads: First—(*A*) in florid phthisis and caseous pneumonias, (*B*) in acute miliary tuberculosis.

Second: In chronic cases. (*a*) As to stage of trouble—(1) in incipient cases, (2) in moderately advanced cases, (3) in advanced cases, (4) cases complicated by marked laryngeal or enteric lesions.

(*b*) As to physical lesions—(1) in localized lesions, (2) in disseminated lesions, (3) in cavitation, (4) in fibrosis, (5) in pleurisy.

(*c*) As to symptoms—(1) in afebrile cases, (2) in febrile cases, (3) in cases with profuse expectoration, (4) in hemorrhagic cases, (5) during inflammatory exacerbations or with spreading trouble.

In considering these various classes we can in the beginning exclude from the application of the method cases of florid phthisis, acute ulcerated phthisis, caseous pneumonias and acute miliary tuberculosis, for all of which there are, unfortunately, no therapeutics save palliative efforts. In the classification as to stage all advanced and complicated cases have to be excluded totally, even when afebrile, while in incipient cases, with practically no exceptions, unless they show a rapid onset, which bodes a very active course, gymnastics can be used with the greatest benefit. In moderately advanced cases we have to use great judgment in our selection. On the whole, I would say that if the majority of the lung is free of involvement or only small areas in two lungs, combined with a good temperature and satisfactory resisting powers, some of these cases will be greatly benefited, but a consideration of the other classifications will make this more plain. In incipient cases we have the largest number of suitable cases, the majority of such being greatly benefited by gymnastics. Classification as to physical signs: In localized lesions, which are inactive or but slightly active, by which I mean cases with but slight or no temperature (not over 99.4), with none or only a few strictly localized dry adventitious sounds, we have the cases best suited to gymnastics and in which they do the most good. When we have disseminated lesions we must be very careful that they are nearly inactive, the temperature normal, and the gymnastics begun very gradually by only quiet deep breathing, but if carefully selected and closely watched we will find many of these cases which will be greatly benefited. In cavitation it is with the single exception of a small dry or nearly inactive cavity unwise, and always during the existence of any activity around the cavity and especially, of course, in multiple cavitation, and I need hardly say that it would be utterly irrational to try to remove by gymnastics the localized thoracic flattenings we find over large cavities, especially in my experience beneath the second and third left ribs in front, such flattenings being the result of a conservative effort on the part of nature. In fibrosis, where the chest is already greatly sunken and bound down, it is evident that it is useless to try to stretch the bands of connective tissue which are responsible for the distortion and it would be undesirable could we do so. When, however, we have a case showing localized fibroid changes I have succeeded in getting most useful and satisfactory compensatory development of the rest of the lung or of the other lung. In pleurisy, if adhesions are extensive and

practically universal, gymnastics again, as in fibrosis, cannot remove them and should only be applied to obtain compensatory development in non-adherent parts of the lungs. If, however, pleurisy is very strictly localized and the large majority of the lung free I consider in the absence of any acuteness of the pleurisy that gymnastics are properly indicated, not to break up an adhesion and free the lung, though this has been advocated, but, as I have frequently insisted, to develop the other portions. As to the CLASSIFICATION AS TO SYMPTOMS: AFEBRILE CASES are, unfortunately, by no means always incipient or localized cases, old and bad cases often being afebrile for long times together and yet steadily going down hill, and I have at this time under my care a case of extensive lesions with a very large cavity in the top of a universally involved left lung and a smaller one in the top of the right lung, and also with intestinal involvement, and where naturally the prognosis is utterly bad, where yet the temperature is practically always normal or slightly sub-normal, but as a general proposition I would say that the temperature should not in the afternoon go over 99.4 and the pulse not be accelerated over 100 if any gymnastics are to be used. FEBRILE CASES, especially if the temperature is 100 or over P. M., are to be entirely excluded, the increased oxygenation and tissue waste produced being here only harmful. IN CASES WITH PROFUSE SECRETION it may be wisest to be very cautious, since it is possible, as has been claimed, that deep inspiration may tend to draw sputum into less involved areas, although this danger, which has often been suggested, has not yet passed the realm of theory. Of course, any cases that have hemorrhagic tendency and in all cases during inflammatory exacerbations, the "poussée de congestion" of the French, or where the process is spreading, gymnastics are absolutely contra-indicated. Thus, to recapitulate the indications: Gymnastics are especially suited to incipient or only moderately advanced cases with localized or slightly disseminated inactive lesions, with temperature not over 99.4 and pulse not over 100, with or without tendency to shrinkage of the chest, narrowing of the shoulders and stoop, or with small, inactive dry cavities or slight dry pleurisies. In these cases it will improve the thoracic form, re-expand contracted but not yet involved areas of lung, increase vital capacity and hæmatosis, improve color index and nutrition, and increase the sense of well-being and strength and raise the vitality. On the other hand, advanced cases or those with generally disseminated lesions

or with active or multiple cavitation or with old advanced fibrosis or with fever and rapid pulse or tendency to activity should be entirely excluded. I would here note that as a general rule I use gymnastics in no case with numerous dry rales and in none with moist rales or with even small areas of active broncho-pneumonia. Turning to methods, I would say that however useful special apparatus may be in the hands of their inventors, they are both too expensive to win general acceptance and have the great disadavantage of necessitating the patients coming daily to the doctor's office for special treatments; so that I would exclude them from consideration. I have found that, granted a patient thoroughly in earnest about getting well and willing to carefully and faithfully carry out orders, and a doctor who will attend to details, more satisfactory results can be obtained with practically no apparatus at all. The simple methods I would recommend I have tested carefully for many years and by them have succeeded in re-expanding contracted chests and increasing vital capacity and improving the pulmonary lesions in a large majority of properly selected cases, and with such a careful selection I have yet to see any serious results, the instances where I have caused temperature rise or increased symptoms having been few and never followed by serious bad effects. The procedure I would classify as (1) simple, quiet, deep breathing with shoulders erect; sitting or standing forced deep breathing aided by (*a*) arm raising and lowering in a transverse vertical plane, inspiring as the arms rise, holding the breath when the hands are over the head and expiring as they fall; (*b*) arm moving in an antero-posterior horizontal plane, inspiring as the arms go backward, expiring as they come forward, or by (*c*) chest expansion by deep breathing with corner exercise, by which I mean placing the hands about two feet from the corner on two walls, falling inward with inspiration, pushing outward with expiration. In afebrile incipient cases or as a prophylactic measure there is no gymnastic I have found so valuable as the (*d*) "figure of 8" swinging of Indian clubs, inspiring as the small circle is made behind the shoulders, expiring as the arms come down in completing the large circle in front of the body. I would also say that with persistent and intelligent patients one can teach the localized use of one side of the chest while not materially deepening the breath on the other side, as has been well shown by LeGrange and Campbell, and that where it is desirable to especially expand one side uni-lateral gymnastics can accomplish excellent results.

Finally, while one's conviction of the utility of any medical procedure can only rightly come from faithfully made personal experience and no report of the work of others should be enough to satisfy us of the value of a measure, I feel safe in asserting that those who will make a careful use of sensible and not too violent gymnastics in properly selected and closely watched cases of pulmonary tuberculosis, keeping tab on their results by the careful monthly use of lead tape, callipers and spirometer will convince themselves, as I have convinced myself, that the measure is capable of producing excellent results, that its use by the profession is entirely justified and that we could ill afford to drop it from the list of our therapeutic measures in pulmonary tuberculosis.

DISCUSSION ON DR. MINOR'S PAPER

Dr. Norman Bridge, Los Angeles, Cal.: This is a very interesting paper and Dr. Minor very wisely said near the beginning that gymnastics for pulmonary tuberculosis must be administered and prescribed with great caution, and in selected cases, and with care that certain and numerous conditions are excluded in which harm might be done by the gymnastics. I fear he has excluded so many conditions for every situation in which gymnastics could be given safely, that hardly any are left.

Immobilization of a lung can only be partial except by infiltration of the chest cavity with sterile air or nitrogen, or with fluid; that of course will completely immobilize a lung. This is all I have ever claimed. I believe the general exercises of the tuberculous patient must be attended to, but that exercise must be proper for them and that exercise only is proper which does not raise their temperature. Deep breathing is unnecessary. It is not true that the world has been breathing wrong for thousands of years. If the general bodily musculature can be developed by exercise there is no need of special chest exercise. Much harm is done by fads of breathing exercises and the exploitation of the notion that we have been breathing wrong. If a patient is exercising bodily generally there is no need of thinking whether he breaths wrong or right; he will breath right every time. My friend has stated that atelectasis invites tuberculosis; how does he know? It may be true but I doubt if anyone knows. I think, too, that he is in error in the statement that in patients with tuberculosis the lung contracts as the result of cavitation. It contracts because of

the fibrosis and by no other way. We have it from the surgeons and others who treat tuberculosis in other parts of the body that there is no question as to the value of immobilization, quietness and quiescence, and against exercise. There is no reason for regarding the lungs as an exception to this rule. Dr. Minor will ask what objections there can be to exercising the lungs, giving gymnastics in the exceptional cases; I think there can be very little objection if wise precautions could always be insisted upon, but the danger is so great of harm coming from lung gymnastics that there is likely to be more harm done than good if we adopt Dr. Minor's rule.

Another consideration of great moment is this: As we emphasize the unessential things we remove emphasis from the essential things. The essential things in tuberculosis are rest, good nutrition, fresh air and cheerfulness. Those are the things of importance. Any influence, or any theory that takes the mind from these measures are harmful to the patient.

This morning Dr. Mayo referred with commendation to the beneficial effect in joint tuberculosis of the ordinary congestion produced by slightly ligating the limb proximal to the disease, continuing this congestion for one hour or so at a time. He insisted there was no question as to the great benefit of this procedure. He believed the benefit comes from the venous congestion produced artificially; it enables the phagocytes to get through the walls of the vessels into the area of the disease more easily, and therefore accomplishes good. If his theory is correct then you benefit the tuberculous patient when you quiet and immobilize the tuberculous lung; and the atelectic spots which Dr. Minor is afraid of are in the best possible position to receive benefit from the quiescence.

Dr. Herbert Maxon King, Liberty: In discussing such a subject it would seem of most value for one to limit his remarks to an expression of his own views as a result of personal experience. Formerly I made it a routine practice in selected cases of tuberculosis, particularly in convalescence and in patients presenting a progressive fibrosis, to carry out a certain system of pulmonary gymnastics. Of late years, however, and after a more intimate experience with consumptives, such as is only possible in a sanatorium, I have come to entertain rather dogmatic views in regard to unnecessary exercise of any sort, and especially with regard to pulmonary gymnastics. I am not prepared to say with confidence that pulmonary gymnastics properly applied do

actual harm, but, on the other hand, I have been unable to determine that they are ever productive of real benefit, and for this reason I do not feel justified in prescribing them. I am of Doctor Bridge's opinion, that if we must err at all, it is safest to err on the side of too much rest rather than too much exercise. One may examine the chest of a patient with a quiescent tuberculous lesion when no exercise or at least unnecessary exercise has been taken and find a complete or nearly complete absence of rales, whereas in the same patient after fifteen minutes exercise rales may be determined in abundance. Forced respiratory movements, it seems to me, are always contraindicated in the presence of pulmonary tuberculosis. I am willing to advocate taking risks where the possible gain to the patient is commensurate, still, I cannot but regard that the possible danger arising from pulmonary gymnastics outweighs any therapeutic value which they possess. I am sorry that I cannot agree with Doctor Minor in applying gymnastics to selected cases. I am unable to do so because I confess to a lack of confidence in my ability to select the proper cases.

Dr. F. I. Knight, Boston: I have no very strong opinion on the subject under discussion. Many years ago, following the practice of some of my friends, I allowed patients in the earlier stages of pulmonary tuberculosis to take a good deal of respiratory exercise and deep breathing. I thought at the time that it was doing them good, but I have gradually given up this practice, patients apparently doing just as well without it. But I will say that I do not remember seeing any harm come from it. I might say, however, that I am open to conviction.

Dr. John H. Pryor, Buffalo: It seems to me that it makes a vast difference whether the observations are made upon incipient or advanced cases of pulmonary tuberculosis. At the New York State Hospitla for Incipient Tuberculosis, a form of gymnastics and deep breathing has been employed since the institution was opened. The rule has been that so soon as they reach the quiescent stage, with temperature normal, without any symptoms pointing to any activity, then the patients are given twice daily deep breathing exercises with arm movements, under the supervision of a physician. The idea was that it was helpful in securing a recovery of the patient by ventilating the lungs and carrying fresh air to the part. It seems quite inconsistent to send patients away to a favorable climate and then not let them use the air. This plan at the institution has been carried out for two years and

when I questioned the superintendent he stated that he had never seen any evil results follow.

There is another phase of the question not yet touched upon. In many instances in the English journals able clinicians have doubted the efficacy of sanitorium treatment; one reason why they are so skeptical is said to be because in apparently recovered cases the patients were sent home fat and flabby, unable to do anything. They were said to be a deceptive mass of fatty cells. When deep breathing is practiced, as at the State Institution, and the patients are sent home they are in the best possible condition and are able to work. If they do not have these exercises they become short of breath and fat; if they walk there is a rapid heart's action and they are unable to do anything for some time, except to hold down a chair on the veranda. There is danger in accepting the extreme view and the individual and the character of the disease must be considered. I deny that conclusive proof has been established to show that exercise of the lung in any incipient case has delayed recovery or the formation of scar tissue. Furthermore the dangers from deeper breathing in advanced cases have been exaggerated and in exceptional cases the exercise is beneficial.

Dr. S. A. Knopf, New York: I believe in breathing exercises both as a prophylactic and therapeutic means. There are certain cases met with at times when I would wish to have the patient refrain from special breathing exercises, but in the majority of cases the little harm that possibly can be done by breathing deeply is well balanced by what we accomplish with increased hæmatosis and greater abundance of oxygen imparted to the general system. If a patient is much depressed let him take the breathing exercises. Then there will be more oxygen in the blood, the anæmia of the brain will lessen or cease, and the man becomes more cheerful. I teach and practice the breathing exercise in my service at the sanatorium at North Brother's Island, New York City, where I have many cases forcibly detained, old chronics, and many alcoholics. All afebrile cases look forward to the time when they are to take the breathing exercises. During my visits there I take them myself, otherwise they are supervised by my resident physician. So far I have never seen any ill results and all the patients tell me they felt better for taking the breathing exercises. The cases with a recent hæmoptysis are not allowed to take the general respiratory exercise. But after a few days I allow them to breathe deeply. This idea did not originate with me. The great immortal Traube in a lec-

ture fifty years ago recommended deep breathing exercises shortly after the cessation of the hemorrhage. I was gratified when Dr. Lawrason Brown, of Saranac Lake, one year ago, told me he had followed this practice in a number of cases and that he had not any cause to regret it. This deep quiet breathing after a hemorrhage will lead to coagulation in the minor vessels. In short, the harm done in the majority of the cases is little; the good done is great. It is an important prophylactic and therapeutic measure, and until I am convinced that it is wrong I shall continue to teach and practice it both as a prophylactic and therapeutic means.

Dr. Agnes C. Vietor, Boston: I have been engaged for some time in making studies of respiration in tuberculous and non-tuberculous subjects, but I am not yet ready to report my observations on the tuberculous patient. This work has shown two sources of error which do not seem to be excluded in the remarks made in this discussion. One is that a distinction does not seem to be made between pulmonary gymnastics complicated and uncomplicated by general exercises; and in general exercise I include actions of the upper extremities. I think I am able to demonstrate that even standing or sitting is a general exercise. I think I am able to demonstrate even postural effects on the respiration. Therefore, to be exact, pulmonary gymnastics should be confined to expansion of the lungs in the supine position, with the body entirely at rest. The second source of error is the introduction of the psychic element. Suggestibility is active in tuberculosis as in other conditions of impaired, or in intact, health. The patient will always be inclined to feel better if he receives the suggestion that his gymnastics, pulmonary or otherwise, are to develop his lungs.

Dr. W. B. Stanton, Philadelphia: I should like to ask Dr. Minor on what he bases his assumption that more oxygen is received during forced breathing.

Dr. Chas. L. Minor, Asheville, N. C.: I think any gentleman who will take the trouble to keep lead tape tracings of the thoracic perimeter of his patients will get positive evidence of the good effects of gymnastics. The functional contraction of a lung as disease develops in it is recognized and is well shown by the fluoroscope, as well as by a study of the apical outlines, and the re-expansion of such contracted lungs under the influence of properly applied gymnastics can be easily followed by these methods of examination. Dr. Bridge is very right in saying that I very carefully limit the cases to which I apply gym-

nastics and I think any doctor would be unfit to practice medicine who did not carefully limit the use of any therapeutic measure, but because its use must be properly limited is no reason why that considerable percentage of cases which can be benefited by it should be denied the advantages they can gain from it. I remarked in my paper that *if*, as Dr. Bridge claims, any gymnastics of the diseased lung is absolutely bad, then, since it has been proven that all bodily gymnastics produces increased motion in the lung, all bodily movements of all sorts should be given up, and I am glad that Dr. Vietor has dwelt upon the effect of bodily motions on pulmonary expansion. One of the speakers has said that the average man naturally breathes correctly, and in this I believe he is right, although a good many people do not properly use their breathing power, but when pathological conditions are present in the lung which cause bad breathing it is necessary that we should teach such patients to breathe properly, and in this connection I would refer to the great importance of teaching proper lung gymnastics to those children whom we so often see whose chests are deformed by rickets, and who, while the thorax is still soft, can be taught to improve their thoracic shape greatly.

As to my statement, which Dr. Bridge doubts, that atelectatic areas are favorable points for the spread of pulmonary tuberculosis, I believe that this has been generally recognized, but probably my friend, Dr. Ravenel, whose knowledge of the pathology of this disease is so thorough, could inform us on this point.

Again I would say that it has been again and again proven that deep breathing will improve the general nutrition of the body, and if, as is generally recognized, our chief aim should be to improve that nutrition in tuberculosis, then gymnastics certainly must be indicated. We should remember, moreover, that gymnastics are not directed merely to their effect on re-expanding the lung as a lung, but more importantly, if more indirectly, to their effect on the system as a whole through the systemic respiration, for one cannot improve the pulmonic respiration and metabolism without improving the metabolism of the whole body. I was very glad to hear such an authority as Dr. Otis approve of gymnastics. I regret that his periods of observation were so short as two weeks. My experiences have been drawn from cases under observation for much longer periods, and I would here say that my attitude towards gymnastics has been brought about as a result of my study of the chest tracings of my patients. I started in to use

gymnastics simply because they were generally recommended, but after a number of years of study of such tracing-records and fluoroscopic pictures I was convinced of the good reasons that lay behind the practice and could not fail to recognize that in all early cases, as I have said in my paper, a decrease of thoracic perimeter was uniformly a bad sign and its increase a good one.

One of the gentlemen has spoken of increased rales after gymnastics. While, as I have said, I do not generally use gymnastics where there are many adventitious sounds in the chest, it stands to reason that gymnastics will mobilize sputum in the chest, which by no means is a harmful thing, as it tends to remove it and free the chest of harmful matter, one of the earlier effects of gymnastics often being a temporary increase of expectoration.

In closing, let me only say, as I said in my paper, that I would ask all to reserve their judgment on this matter until they have given gymnastics a faithful and intelligent trial in selected cases and studied them closely by such lead tape tracings as I have referred to.

USE AND ABUSE OF PULMONARY GYMNASTICS

By Edward O. Otis, M.D.

Boston

Pulmonary gymnastics, or deep breathing, which are quite generally recommended and used in the treatment of pulmonary tuberculosis, are all too frequently thus recommended and employed, both by the physician and the patient himself, in a vague, indefinite and indiscriminate fashion, both as to the method of their application and as to the class and condition of the patients to which they are applied.

Moreover, both the advocates of pulmonary gymnastics and those who are opposed to them argue upon more or less hypothetical grounds. What seems to be needed is a series of observations and comparisons made upon patients representing as nearly as possible the same general and local conditions; and until such are at hand, we can only discuss the question from personal experience and convictions derived therefrom, and upon general principles.

At the Massachusetts State Sanatorium for Tuberculosis the resident physicians, Drs. Dunham, Lapham and Crane, have kindly made at my suggestion a series of such observations and comparisons. Drs. Dunham and Lapham took thirty-seven patients, men and women, who were in the quiescent stage of the disease, with no temperature, and who were or had been gaining in weight. They were, in general, improving cases and were taking a limited amount of exercise. They represented all stages of the disease. All had more or less cough, and nearly all had bacillary sputum. Two periods, of two weeks each, were taken. In the first period they were told to refrain from deep breathing and take shallow breaths, and in the second period they were encouraged to breathe deeply and four times a day to practice forced respiration. Of course the periods were too short to permit anything more than a very general inference as to the effects of deep breathing. In fact, practically no change in the condition of the patients occurred

during the two periods. In no case was any ill effect observed during the deep breathing period, or was the favorable course of the disease prejudiced. The exacerbations which happened to occur during the trial all occurred during the shallow breathing period, probably only a coincidence. Almost all expressed themselves as feeling better while practicing deep breathing.

Dr. Crane reports the results in forty-three cases who were given for a much longer period of time class gymnastics, in which deep breathing was included, and then for a period of months such exercise was omitted. No material difference in the condition of the patients or the progress of the disease was observed during the two periods; but, as in the other series of cases, the patients generally expressed themselves as feeling better and eating better during the exercise period. In these cases also no ill effects resulted.

So far as deductions can be drawn from these experiments, they would indicate that at least no harm results from the employment of pulmonary gymnastics in properly selected cases, or that any appreciable influence is produced upon the course of the disease, except that the patients feel better and imagine, at least, that deep breathing is beneficial to them.

In any intelligent discussion of the problem, we must first define what we mean by pulmonary gymnastics. Do we mean simply deep breathing with or without supplementary arm movements, or, in addition, various exercises of the body, which, as all exercise does to a greater or less degree, augment also the pulmonary action, such as free hand class work, walking up hill, games, etc.? I understand that in this discussion the former is meant, namely, deep breathing with or without arm movements, such as can be practiced either standing, walking or reclining. In the second place, we must agree upon the stage and activity of the disease and the general condition of the patient in which pulmonary gymnastics are admissible if it is granted that they are admissible at all.

In general, I should define the suitable cases as those which are in the process of arrest, with no acute symptoms and in good or improving general condition, and the incipient cases with little or no activity and with no marked evidence of general deterioration.

Scultzen[1] considers the so-called curable cases with not far advanced

[1] "Ueber Atmenübungen bei der Behandlung der Lungentuberculose," von Stabsarzt Dr. Schultzen, Berlin. *Zeitschrift für Tuberculose und Heilstättenwesen*, Vol. 1, p. 135, 1900.

disease and with no acute symptoms or complications as the favorable ones for pulmonary gymnastics, although he says that at the sanatorium at Grabosee, when the material was not always of the best, from 65 per cent. to 75 per cent. of the patients took lung gymnastics.

We all would agree, I suppose, that those which are considered to be "rest" cases, either on account of increased temperature, rapid pulse, or their general condition—in brief, the acute or non-quiescent cases, are unsuitable for pulmonary gymnastics. Ransome lays great stress upon keeping the range of respiratory movements, in acute cases, as small as possible, in order that there be "no disturbance of underlying inflamed tissues, and no dragging upon any adhesions which may have formed between the two layers of the pleura." He considers it most important that there should be entire repose of the bony levers overlying the injured part.[1]

Having defined pulmonary gymnastics, and selected the class of cases suitable for them, we have the double problem to consider: First, does deep breathing hasten the process of arrest both by its influence upon the local and general condition; and, secondly, is such deep breathing, if it produces no observable beneficial influence upon the patient, likely to do harm?

For our answer we have largely to depend upon the personal experience of various observers, and upon abstract reasoning from general physiological and pathological principles. Liebermeister, Volland, Michaelis, Cornet, and others, have expressed their opposition to this form of exercise, either as the result of their personal experience, or upon theoretical grounds. The dangers they have observed or fear are aspiration pneumonia; interference with the formation of a zone of demarcation (Cornet); tendency towards hæmorrhage; the development of emphysema; the tearing apart of delicate cicatricial tissue and conservative pleural adhesions; conditions favorable to the growth of the bacilli, and increased absorption of proteins (Cornet); aspiration of bacillary sputum into other portions of the lungs.

On the contrary, Dettweiler, Turban, Meissen, Professor A. Fraenkel, Schultzen, and many others, all from extensive personal experience, favor and employ, under carefully guarded conditions, pulmonary gymnastics.

Dettweiler, after giving very careful instructions as to how deep

[1] "The Principles of Open-air Treatment," Ransome, 1903, p. 19.

breathing should be applied, concludes by saying that "the habit" (deep breathing) will become a necessity, and through its means the troublesome tendency to constantly cough will be blunted.[1] He also adds that it is often wrongly applied.

Turban[2] declares that he has employed many times with advantage deep breathing cautiously and methodically applied; and has found it of especial value, he says, with the habitually weak breathers. "It is doubtless true," he continues, "that an extreme expansion of a tuberculous lung may result fatally, but it is equally true that methodical deep breathing increases the ventilation and circulation of the lungs, and therefore improves their nutrition." Turban's method is by taking five to ten times daily ten to twenty full breaths at a time in the reclining position. Fraenkel's method is practically the same: every one-quarter to one-half hour ten to twenty quiet deep breaths are taken, the mouth being closed.

Schultzen[3] says that pulmonary gymnastics adapted and applied by the physician to each individual case, and carefully and constantly supervised, are a very valuable aid in the treatment of pulmonary tuberculosis, and deserve to be systematically employed with each tuberculous individual, in whom, after a careful examination, no contra-indication exists. He further says that improper body positions, round, stooping shoulders, and weak respiratory muscles are improved thereby.

At the sanatoria of Belzig, Friedrichsheim, Leysen, Hohenhonnaf, and Nordrach on Dee, pulmonary gymnastics are employed in properly selected cases.

Reasoning from a physiological basis, if good breathing is necessary for the maintenance of the pulmonary tissue in a healthy condition, as well as the whole organism, through properly aerated blood; and if insufficient expansion of the apices is a predisposing cause of tuberculosis as is alleged; then, when the lungs are diseased, proper ventilation through efficient respiration might be assumed to be one of the natural means to be adapted in the effort to restore the integrity of the lung tissue and rendering it as well as the whole organism resistant to the infection, on the reverse principle of "similia semilibus curantur." And this is the theory which has been and still is largely in vogue,

[1] "Die Therapie der Phthisis," Dettweiler, 1887, p. 29.
[2] "Beitrage zur Kenntniss der Lungen-Tuberculose," Dr. K. Turban, 1899, p. 124.
[3] *Loc. cit.*

particularly among the laity, as witness the wide use of the breathing tube, which is only a means of effecting pulmonary expansion. On the other hand, those who are opposed to pulmonary gymnastics in any stage of the disease, have their argument upon the general principle of rest to an injured or diseased part or organ. A tuberculous joint, they say, is put at rest by the surgeon. In peritonitis we endeavor to restrict peristalsis in order to keep the peritoneum at rest. In certain cardiac diseases we use digitalis to increase, among its other effects, the intervals of rest, etc. Why not, on the same principle, restrict as far as possible the movements of the diseased lung?

I fail to recognize the analogy between the case of a tuberculous joint and a tuberculous lung, referred to by Cornet and others, for, as Neitzert well says,[1] the immobility of the joint or even its amputation produces no severe injury to, or prejudices the functions of, the body as a whole. The lungs, on the contrary, influence by their function the whole organism. They must furnish oxygen to the blood that it may properly nourish the body and eliminate carbonic acid gas. When this function of the lungs is interfered with, not only the whole body but the lung tissue itself suffers. Only through efficient respiration can the need of the body for properly aerated blood be met.

It may be well here to remember that the vast majority of tuberculous individuals cough more or less and the act of coughing necessitates deep breathing, so that the consumptive as a rule is really practicing deep breathing in an irregular fashion, whether he will or no. Furthermore, the act of respiration either in the sick or well is not steadily uniform but ever varies in its amplitude. Every exertion—taking the morning bath, walking, going upstairs, talking, and the innumerable daily movements—increases the respiratory excursion, to again diminish during repose. So that the question of efficient breathing resolves itself to a certain extent into one of degree and regularity; of doing with uniformity and systematically what is done any way irregularly and spasmodically. And then we have pulmonary gymnastics.

The contra-indications to pulmonary gymnastics are given in detail by Schultzen,[2] with which I think we would all substantially agree. They are as follows: (*a*) Fever; (*b*) great bodily weakness; (*c*) acute inflammatory process of the lung tissue; (*d*) evident advancing soften-

[1] *Zeitschrift für Tuberculose und Heilstättenwesen*, Band 5, p. 126, 1904.
[2] *Zeitschrift für Tuberculose und Heilstättenwesen*, Vol. 1, p. 135, 1900.

ing or disintegration of the lung tissue; (*e*) increasing extension of the local tubercular lesions with rapid increase of the same accompanied with very copious persisting expectoration; (*f*) newly formed or old large cavities; (*g*) recent inflammation of the pleura or increasing pleural effusion; (*h*) existing hæmorrhage or that which has recently occurred, even of the smallest amount unless from stasis; (*i*) pathological conditions of the blood; (*j*) advanced tubercular laryngitis, especially ulcerative and accompanied with perichondritis; (*k*) intercurrent diseases, or severe complications on the part of other organs; (*l*) possible unexpected occurrences of disturbing phenomena which may be produced or excited by the pulmonary gymnastics.

It may be useful also to give the exact method of deep breathing as employed by Meissen, Nahm and others. First: a deep inspiration is taken through the nose, the mouth being closed. Second: the breath is held for a moment. Third: a deep expiration through the nose or mouth. The inspiration can be strengthened by gradually raising the arms to a horizontal position or over the head, and letting them fall in expiration. The expiration can also be strengthened by uttering a short word at the end of expiration; for example, "one," then "two," etc. Six such breathing movements are to be taken at one time, which may be repeated many times during the day, and they may be performed either reclining, standing, or walking. Violent and fatiguing efforts in deep breathing are to be avoided.

To summarize: With carefully selected cases, in which none of the contra-indications above mentioned exist, cases with no acute symptoms and with a tendency towards arrest or well on the road to arrest, and possessing a certain amount of vitality, pulmonary gymnastics carefully applied and supervised would appear, both from experience and theory, to be useful in aiding and hastening the arrest; at least there is no conclusive evidence that harm results therefrom. Furthermore, the patients themselves express a sense of well-being from such deep breathing and the mental effect is of value. Used in unfit cases, and many cases on the border line can only be determined as fit or unfit by trial, harm may obviously ensue.

The Abuse of Pulmonary Gymnastics

From what has been said above, it is obvious that pulmonary gymnastics are to be applied with the same discrimination and individual

application as any other form of treatment. Indiscriminate use of them can only be followed by the same results as the indiscriminate use of any other remedy, sometimes to good effect, sometimes to the injury of the patient. It may again be repeated that all cases and all stages are not suitable for the employment of pulmonary gymnastics; but, on the other hand, other cases are, and the evidence at hand would appear to prove their value.

DIET IN TUBERCULOSIS

By Herbert Maxon King, M.D.

Liberty, N. Y.

From time immemorial the human race has paid its tribute to consumption, and it is fairly certain that from the start a proportion, sometimes great and sometimes small, of those affected, have been able by conscious effort or otherwise to throw off the disease and recover. It is equally safe to assert that where this has occurred it has always been primarily by virtue of an improved nutrition—however accomplished.

There is a very general impression to-day, not confined to the medical profession by any means, that if we "build up the patient the disease will take care of itself," and it is also generally conceded that the requisites to this building-up process are essentially—good food, pure air, and proper rest. Other factors there are, to be sure, which may contribute toward the desired result—climate, light, water, drugs, etc., but they are of secondary importance.

So far, then, the problem seems easy of solution, and it is not surprising in view of the apparent simplicity of the prescription, that the question is sometimes asked: "Why, then, if this is all that is required do not more consumptives recover?"

But is the prescription after all so simple as it appears? What is *good* food? Is there such a thing as a *standard* diet? Will the same relative proportion of proteids, fats, and carbohydrates which serve so well with A, be equally productive of good results in B? Is it merely a question of calorific values? The same with air; which may be equally pure at sea level or at an altitude of five thousand meters. Where can pure air be found which will be most efficacious for the consumptive? What degree of relative moisture is most desirable? And have we any standards of pure air applicable to all consumptives alike, or even to all of a single class?

Again with rest. How far should we carry restrictions as to exer-

cise? Under what conditions can rest be most advantageously secured? Is there not a very real danger of falling into the thraldom of routine in our practice with regard to rest for the tuberculous invalid? These are some of many questions which I fear have not received that scientific scrutiny which characterizes so much in modern medicine.

In combating tuberculous disease the means at our disposal are of a necessity limited, and for this reason, if for no other, it would seem that they should be applied with all the more care and circumspection. Yet, I am of the opinion that nowhere else in the practice of medicine is there a more extravagant or indiscriminate misuse of the means at hand than we are forced to see in the prescriptions for good food, pure air and proper rest which are given to the consumptive patient "to apply as required" upon his own initiative. It is, as it were, to tell a patient with syphilis that mercury is a cure for his disease and leave to his own untrained and imperfect judgment the selection of the preparation, the dosage, and the mode of administration.

We must not forget that in such a matter as that of diet, while there is no doubt a standard of excellence, it is an *individual standard* rather than a *class standard* and must be worked out with as many variations almost as there are patients if the best results are to be obtained. One patient may do well and recover on the coarse fare of a Canadian lumber camp, while another's success may depend upon the most cunning exercise of the culinary art.

But although it may not be possible to formulate a dietary acceptable as a standard for tuberculous invalids as a whole, there should be no difficulty in agreeing upon certain fixed principles generally applicable and which should serve as a basis upon which to build the group or individual dietary.

For instance we should arrive at some definite conclusions regarding the food requirements of the organism in the presence of certain pathological conditions and under identical climatic influences. We should determine the amount and relative proportions of proteids, fats, and carbohydrates per kilo of body weight required to nourish properly the consumptive whose disease is in abeyance and whose weight, temperature and pulse are normal. Of course, such a standard could only serve as a working basis. The real difficulties of the problem follow, for it is one thing to determine what the system requires and quite another to know how best to supply it in a form to be available to the tissues.

But even a working basis, however limited its application, would be an improvement over the present chaotic state of our information with regard to diet in tuberculosis. Consider in what manner we are in the habit of advising our patient in this respect. We have explained to him the nature of his malady, and have exhausted our eloquence in impressing upon him the vital necessity of hyperalimentation as the primal factor in combating his disease. We have given him a list of foods which he must take in addition to three generous meals a day. Safe to say at the head of this list are the ubiquitous milk and raw eggs to be consumed in as large quantities as the patient can manage! We have advised that he eat meat three times daily, take large quantities of fat, and limit his vegetables chiefly to those of a leguminous nature. This prescription for a dietary, and you know I have not exaggerated, reminds one of the original Warburg's tincture; something out of the whole ought surely to hit the mark and if the patient can survive the effects of the balance he ought to get well.

A case in point came under my observation not long ago. It was that of a young man of twenty years. For a month previous his diet had consisted of three hearty meals a day and in addition he had taken three litres of milk and twenty raw eggs every twenty-four hours. I asked him if his physician had ordered this and he replied, "No, not exactly, but he told me to eat all the meat I could and to take as much milk and as many raw eggs as I could stand besides; and I found I could not stand any more than this without vomiting!"

He had gained something like nine kilos (twenty pounds) in weight during the month, but as may be imagined, his digestion was hopelessly ruined and in the course of time he died. Roughly estimated this young man was daily taking into his stomach 375 grammes of albumin, 350 grammes of fat, and 500 grammes of carbohydrates, representing a total of 6,842 calories.

I regret to say that I do not think this a very unusual instance, but it well demonstrates the unwisdom of open prescriptions and illustrates the grave danger of leaving a tuberculous patient to his own initiative.

Much good work has been done in the study of food metabolism, with a result of determining approximately the amount of food necessary to maintain good health in a normal, adult, human being. Represented in calories the generally accepted standard is thirty to thirty-five calories per kilo of body weight while at rest, and about forty

calories per kilo of body weight for an individual under the ordinary conditions of life.

The relative proportions of the classes of food stuffs going to make up this number of heat units are theoretically: proteids twelve, fats five, and carbohydrates fifty (Voit's Standard) daily. However, not only the relative proportions but the daily total of food must necessarily vary with varying conditions both of the individual and of his environment, and these conditions are so manifold and complex when it comes to treating the tuberculous invalid that it becomes at once apparent how impossible it is to arrive at any specific standard of diet generally applicable in the presence of this disease.

Moreover, it is very doubtful if the last word has been said as to the food requirements of a healthy human being. I am inclined to believe that we have been making a fetish of proteids and fats and have paid too little attention to the carbohydrates.

A good digestion, of course, simplifies the problem. Given a sufficiently generous diet, nature will attend to the demands of the organism. There need be no anxiety as to the relative proteid, fat, and carbohydrate content of the ingested food, and in such cases the appetite alone is a sufficient criterion.

A good digestion, however, is rather the exception than the rule. Digestive disturbances are the most common antecedents of tuberculosis, and are apt to continue as harassing complications throughout the course of the disease. Thus with a poor digestion and assimilation, it is of the greatest importance not only to ascertain approximately the digestive capacity of the individual for the several elements, but to avoid overfeeding either in total quantity of food or excess of any constituent element. It is often astonishing what can be accomplished with a little patience and study in improving nutrition in a dyspeptic consumptive simply by judicious restrictions and tentative modification of relative proportions of ordinary food constituents. On the other hand, the results of most painstaking effort are not infrequently disappointing and discouraging, and, without being able to ascribe a cause, we may be forced to see a patient continue to lose weight and strength even while ingesting an amount and variety of food more than sufficient to sustain a robust working man.

Such a case recently came under my observation at the sanatorium: A woman, 34 years of age, weighing 62.302 kilos ($137\frac{1}{16}$ pounds), with a barely demonstrable incipient lesion of the right apex, no bacilli in

the very scant expectoration (they had been demonstrated, however, a month before), no elevation of temperature and a normal pulse. The estimated normal weight for a woman of her height and years was 62.7 kilos (138 pounds), but a year prior to her admission she had weighed 71 kilos (156 + pounds). She was thus considerably under her maximum weight. Her appetite and digestion were apparently excellent, her bowels and kidneys functionated normally and she was not homesick. During a residence of three months, however, she continued persistently to lose weight, although not in large amounts, and this on a diet which was varied from time to time but which averaged over 3,000 calories per day, or forty-eight calories per kilo of the patient's body weight.

The daily food régime in this case was about as follows, estimating the amount *consumed:*

Breakfast 8 a. m.
Cereal,
Two eggs,
Two glasses of milk,
One slice of bread or toast;
Lunch 10.30 a. m.
Egg-nog made with two eggs;
Dinner 1 p. m.
Soup,
Roast,
Two vegetables,
Salad,
Dessert;
Lunch 3.30 p. m.
Egg-nog made with two eggs;
Supper 6 p. m.
Cold meat,
Bread and butter,
Two glasses of milk,
Fruit;

or approximately 130 grammes albumin, 156 grammes fats and 260 grammes carbohydrates. It will be noticed that these proportions vary somewhat from those usually indicated for healthy individuals under ordinary conditions of life in that the proteids are slightly increased, fats greatly increased (more than three times the amount called for

in Voit's Standard), while the carbohydrates are diminished relatively about 50 per cent. Yet I believe that this diet comes nearer the average prescribed for the tuberculous invalid with a quiescent lesion than may be supposed.

During the fourth month of this patient's sanatorium residence, a rather radical change was made in her dietary with a view of checking the weight loss. Proteids were cut down to less than 120 grammes and fats were reduced not to exceed 60 grammes per day. This was largely accomplished by substituting skimmed for whole milk and by cutting out the yolks of eggs. At the same time the carbohydrates were greatly increased, an effort being made to reach 500 grammes per day and thus more nearly approximate the regulation standards.

The results, however, were not very flattering. Further loss was, to be sure, checked but on discharge at the end of the fourth month the patient had gained back but two or three hundred grammes of the three kilos lost during residence, yet in this case the patient *felt well,* enjoyed her food and apparently completely overcame the pulmonary lesion.

In rather striking contrast to this is the following case: A girl 17 years old, with an extensive lesion and cavity in the right lung and a considerable area of infiltration deposits in the left lung, daily elevation of temperature, accelerated pulse, appetite poor, digestion and elimination fairly good, distinctly an infirmary case, notwithstanding which this patient made very satisfactory gains in weight on a diet representing only 81 + grammes albumin, 102 + grammes fat, and 215 grammes carbohydrates, a total approximately of 2,315 calories, or as the patient's weight was 43.5 kilos, 53.2 calories per kilo.

At the same time in an adjoining room in our infirmary, a young woman with a very similar pulmonary condition and constitutional reaction, but with some digestive disturbance, rapidly lost weight on a diet averaging 106.4 grammes albumin, 128 grammes fat and 215 grammes carbohydrates, a total approximately of 69.5 calories per kilo of the patient's body weight.

Of course, it is not merely a question of the amount and latent heat value of fuel put into the furnace, but of even greater importance, the completeness of the actual combustion upon which depends the total of energy derived.

The theoretically ideal diet utterly and inevitably fails to accomplish its purpose when there is not the power to metabolize it to the require-

ments of the tissues. Indigestion, mal-assimilation, defective elimination, whether dependent upon psycho-neurotic causes, or upon profound organic changes bring about one and the same result so far as body nourishment is concerned, and this is what makes the real problem of nourishment in the consumptive patient.

Suppose we have ascertained by experiment that an individual can metabolize satisfactorily 100 grammes albumin, 50 grammes fats and 200 grammes carbohydrates daily, but cannot exceed this amount without giving rise to more or less disagreeable symptoms. While we may be perfectly aware that this total falls below prescribed standards and may not suffice to produce phenomenal weight gains, I am strongly of the opinion that in the long run better results will be obtained from this small diet than will follow a stuffing process with a diet two or three times beyond the individual's capacity for metabolism. Hyperalimentation may be an excellent practice in certain cases under constant skilled supervision, but indiscriminately applied it is capable of working irreparable mischief.

The tuberculous patient with a quiescent lesion and good digestion like the healthy individual, undoubtedly eats more than his body actually requires, but here nature takes care of the unused residue and no harm ensues. Not so, however, in the consumptive with an active lesion and a tendency to digestive disturbance. Here unabsorbed food products and such as have been incompletely broken up become an actual menace in the alimentary canal and too often are responsible for the most serious complications.

In the institution, experience and a little common sense soon work out a very satisfactory mixed diet applicable to the average patient presenting a favorable prognosis such as are admitted to most sanatoria. This, I confess, is usually accomplished without recourse to scientific research.

With a view of establishing a working standard, so to speak, for certain classes of tuberculous invalids the following experiment was recently made at the Annex of the Loomis Sanatorium:

Twelve patients, equally divided as to sex, were selected with reference first to similarity of pulmonary condition, all but one with quiescent or arrested lesions, and that one with but a very moderately active lesion. Second, with reference to similarity of weight, the men, represented in the table following by one to six, inclusive, averaging eleven or twelve kilos more than the women, represented in the table

by the numbers seven to twelve, inclusive. And third, with reference to a close approach of each patient to his or her normal weight. It will be noticed that in all but one case the patients were slightly below the indicated standard. Nevertheless, the appearance was that of a very well nourished group of individuals.

These patients were placed at a table by themselves and their food, while not differing from that of the other patients either in quality or quantity, was accurately weighed and recorded for a period of fourteen days.

The test patients' net weights were ascertained after breakfast in the usual manner employed at the sanatorium, at the commencement of the test and again at its close. The urine and feces were weighed and superficially examined during the test, but as it was not practicable at the time to do certain work with the feces, which alone could have made the observation valuable, the feces record has been omitted. In the case of the urine, the twenty-four hour amount, specific gravity and total solids were estimated and recorded; but no exhaustive analyses were attempted and thus the records have no value as indicating the proteid metabolism or nitrogen output except in a most general way. At the close of the experiment the food actually consumed by each individual was totaled in its several constituents and separated into its albumin, fat and carbohydrate content respectively. From these totals daily averages were ascertained. The fuel value, estimated in terms of large calories, was also recorded. It is here necessary to explain some minor discrepancies which may be noticed between the calorific values in the following tables.

Authors differ somewhat in estimating the heat producing value of various articles of food, and instead of following the plan of working out each item separately, I have whenever possible taken the calorific value as given in the work most convenient to hand at the moment. Chiefly I have had recourse to the excellent tables compiled by Atwater and Bryant and published at the Government Printing Office. These tables are undoubtedly the most reliable of any available for use in this country, although they differ often considerably from the German and French tables, probably owing to the difference in food composition and methods of cooking. But in some instances I have employed tables of other authors, and as the figures obviously can be no more than vaguely approximated, I have not deemed it necessary to reconcile them.

The following menu represents an average of that employed during this experiment and does not differ materially from the food régime of the Annex of the sanatorium during the past winter. It may be of interest to note that this dietary has cost the institution during the past six months on a basis of forty patients, thirty-five cents per patient per day, about one-third of the cost of the more elaborate dietary provided for the patients in the main division of the sanatorium, yet of about the same practical value.

MENU.

Breakfast—7.30 a. m.

	Grams.	A	F	K	C
Fruit	71	3.02	0.22	19.99	87.55
Cereals	41	2.43	0.32	14.04	70.38
Bacon, etc	7	0.97	3.42	0.00	11.89
Eggs	100	14.40	11.30	0.00	163.70
Breadstuffs	37	2.37	5.76	18.67	102.13
Butter	8	0.08	6.80	0.00	63.66
Milk	347	11.45	13.88	17.35	248.80
Cocoa	129	6.26	47.28	48.63	660.61
Coffee	102	0.00	0.00	0.00	0.00
Total	842	40.98	88.98	118.68	1408.72

Morning Diet—10.00 a. m.

Milk	380	12.54	15.20	19.00	273.46
Eggs	50	7.20	5.65	0.00	81.85
Total	430	19.74	20.85	19.00	355.31

Dinner—12.30 noon.

Soup	145	4.29	0.00	0.72	67.93
Fish	9	1.71	0.11	0.00	8.14
Meat	49	10.17	10.51	0.26	140.91
Vegetables	133	4.08	2.89	18.11	115.33
Breadstuffs	38	3.86	1.76	22.74	126.23
Butter	8	0.08	6.80	0 00	63.66
Milk	347	11.45	13.88	17.35	248.00
Desserts	62	2.22	4.09	20.43	132.76
Total	791	37.86	40.04	79.61	902.96

Afternoon Diet—3.00 p. m.

Milk	380	12.54	15.20	19.00	273.46
Eggs	50	7.20	5.65	0.00	81.85
Total	430	19.74	20.85	19.00	355.31

Supper—5.30 p. m.

Cereals	15	0.52	0.20	3.78	19.94
Meat or fish	49	8.20	6.39	2.36	105.51
Vegetables	55	1.67	0.29	10.95	54.74
Breadstuffs	26	2.39	0.09	12.68	65.07
Butter	8	0.08	6.80	0.00	63.66
Milk	347	11.45	13.88	17.35	248.79
Fruit and cake	58	1.09	1.35	20.37	102.38
Tea	81	0.00	0.00	0.00	0.00
Total	639	25.40	29.00	67.49	660.09

Evening Diet—7.30 p. m.

Milk	380	12.54	15.20	19.00	273.46
Total	380	12.54	15.20	19.00	273.46

Breakfast total	842	40.98	88.98	118.68	1408.72
Morning diet total	430	19.74	20.85	19.00	355.31
Dinner total	791	37.86	40.04	79.61	902.96
Afternoon diet total	430	19.74	20.85	19.00	355.31
Supper total	639	25.40	29.00	67.49	660.09
Evening diet total	380	12.54	15.20	19.00	273.46
Total	3512	156.26	214.92	322.78	3955.85

The results of this experiment are given in detail in the table on p. 404. :

It will be seen by reference to the table that eleven of the twelve patients made satisfactory, though not phenomenal, gain in weight, averaging 763 grammes (about one pound ten ounces) per patient. So far as calories per kilo of body weight are concerned, it will be noticed that patient twelve, who lost 680 grammes during the experiment, was consuming about the same as patient two, who made a gain of 115 grammes.

On the other hand, patients one, seven, ten and eleven, who consumed about eighty calories per kilo of body weight, averaged a gain of 812 grammes, while patients two, four and nine, who consumed under fifty-five calories per kilo, averaged but 227 grammes, and patient twelve, who, as above remarked, fell below fifty calories per kilo, lost 680 grammes.

The total solids in the urinary excretion follow roughly in each case the amount of the proteid in the food consumed, and in so far indicate that about the same relative proportion of albumin ingested was metabolized by each patient.

AVERAGE DAILY FOOD ALLOWANCE.

Case No.	Pulmonary Condition.	Pulse Range.	Temperature Range.	Daily Exercise.	Albumin.	Fats.	Carbohydrates.	Total Calories.	Calories per Kilo.	Normal Weight.	Weight Before. Kilos.	Weight After. Kilos.	Gain.	Loss.	Excretions.		
															Urine.	Sp. Gravity	Total Solids
													Gms.	Gms.	cc.		Gms.
1	Disease arrested.	92–120	97.2°– 98.4°	2 hours.	215.33	241.47	442.01	4940.76	80.39	64.318	61.462	61.803	340		1950	1.014	63.60
2	Quiescent.	96–108	97 – 99	2 hours.	136.24	141.68	289.12	3061.60	47.95	66.679	63.844	63.957	113		1200	1.020	55.92
3	"	76–96	97.4 – 98.8	None.	198.54	215.72	311.54	4097.52	62.13	80.287	65.318	66.565	1247		2100	1.016	78.28
4	"	80–104	96.6 –100.6	½ hour.	149.95	168.64	293.42	3386.17	52.48	71.668	64.524	64.638	114		1800	1.016	67.10
5	Disease arrested.	76–92	97.4 – 98.6	2 hours.	189.58	236.56	357.49	4443.00	65.93	68.947	70.875	71.668	793		2700	1.014	88.07
6	" "	84–100	98.4 – 99	None.	183.90	201.71	336.89	4011.14	64.07	62.596	62.596	63.617	1021		1800	1.020	83.88
7	" "	84–108	97 – 98.4	1 hour.	158.66	199.30	328.64	3851.42	76.84	53.524	50.122	51.597	1475		900	1.020	41.94
8	Quiescent.	84–96	96 – 97.6	1 hour.	164.76	118.44	344.13	3187.94	59.56	56.600	53.524	54.885	1361		1950	1.012	44.52
9	"	96–120	97 – 99	None.	125.19	129.81	231.43	2649.38	54.84	61.236	48.308	48.862	454		1350	1.016	50.32
10	"	80–108	96 – 98.6	1 hour.	197.85	217.88	412.27	4527.78	83.88	54.885	53.978	54.772	794		900	1.018	37.34
11	Moderately active.	72–120	98.4 –100.4	None.	177.72	184.61	310.29	3717.71	76.60	55.339	48.535	49.215	680		1500	1.014	48.93
12	Quiescent.	72–128	98 – 99.2	None.	95.20	96.27	206.98	2134.25	44.08	59.875	48.421	47.741		680	1200	1.015	41.94
	Average.	12 patients.	14 days.		166.08	179.34	322.02	3667.39	64.06				763				58.49

On the whole, this dietary has seemed to us to meet, in a fairly satisfactory manner, the requirements of the class of tuberculous invalids treated in the Annex division of the Loomis Sanatorium. Nevertheless, I have felt that the proteid constituent in the dietary has been in excess of the tissue needs, and if so, that an unnecessary and perhaps harmful tax was thus imposed upon the organs concerned in proteid metabolism and elimination.

If, as Folin has so ingeniously suggested (*The New York Medical Journal,* March 3, 1906), the urea output does not at all, or but slightly, represent tissue catabolism but on the contrary merely the unused and consequently superfluous product of metabolism of the proteids of the food, then it is obvious that whenever urea excretion is considerable, the proteid constituent of the diet is in excess of the body needs and it is well known that in quiescent cases of tuberculosis on heavy proteid diets the urea excretion exceeds the average for a healthy person under the ordinary conditions of life, just as occurs in the normal individual under otherwise similar circumstances. This is certainly a matter deserving further inquiry.

A further experiment was undertaken at the Sanatorium Annex with a view of determining the effects of a diet rich in carbohydrates and relatively poor in proteids, as compared with a heavy proteid diet, poor in carbohydrates. But, as the plan adopted in this experiment could not be satisfactorily carried out in the time intervening before the date of this meeting, I cannot at this time report upon it.

Generally speaking, a tuberculous invalid without acute symptoms may be given a properly proportioned diet of from forty-five to eighty calories per kilo of body weight, without danger of overfeeding; but one must exercise vigilance for there are many exceptions to this general rule. For instance, I have a patient who does well and gains weight upon about 2,500 calories per day, divided as follows: 88 grammes albumin, 129 grammes fat, 197 grammes carbohydrates; but whenever I have attempted to increase this diet I have been met by digestive disturbance and weight loss. In this case the diet represented about forty-eight calories per kilo of the patient's weight.

Phenomenal weight gains in patients who have come under treatment greatly underweight, satisfactory as they are to the patient and to his family, should at once arouse a suspicion of overfeeding; an investigation in such cases not infrequently discloses the fact that the diet is approaching one hundred calories per kilo, which is cer-

tainly a danger point, however well the patient may look and feel for the time being. In acute cases, with high temperatures and rapidly destructive lesions, a heavy proteid diet is quite as much out of place as it would be in typhoid fever. Yet nourishment must be supplied if we expect to change the type of the process. It is in such cases that an almost exclusive milk diet best serves the purpose—raw, cooked or variously modified, milk is the food with the widest range of usefulness in these cases. Three litres of whole milk divided into unequal portions, the largest to be given at ordinary meal times, can be taken by most patients without inconvenience every twenty-four hours, and represent 99 grammes of proteids, 120 grammes of fat, and 150 grammes of carbohydrates, or 2,137 calories. This is, of course, insufficient for the body needs in such cases, and will not prevent weight loss but it will check it, and will give the organs concerned in digestion, assimilation and elimination the least strain at a time when it is most urgent to save the patient all unnecessary expenditure of energy.

As the type of the disease changes, which fortunately it does more often than might be expected, this milk diet must of course be supplemented and gradually superseded, for it cannot with safety be indefinitely continued. In advanced cavity cases much underweight and without appetite, but without acute symptoms, the ordinary three or four meals a day will not serve. Such patients cannot or will not undertake the effort of eating a sufficient amount, however attractively it may be served from the regular trays. It has been our custom in the infirmary of the Loomis Sanatorium in such cases to substitute a two-hour diet for the regular meals. The following is a fair representation of such a dietary and answers the purpose very well. It is subject, of course, to more or less daily modification to meet the whims and tastes of different patients or of the same patient on different days.

It will be seen that such a dietary for a patient weighing about forty-five kilos (100 pounds) is equal to slightly over sixty calories per kilo of body weight. In such cases as would require a two-hour diet of this kind I do not believe it wise to increase the proteid constituent, nor do I think anything is to be gained by increasing the fats, but when weight gain is not forthcoming after reasonable trial on such a diet, the carbohydrate constituent may be gradually increased to 350 or 400 grammes, and if well borne by the patient will very likely result in weight gain and generally improved condition.

CLINICAL SECTION

	Grams.	A	F	K	C
6 a. m.—Milk.....	190	6.27	7.60	9.50	136.23
8 a. m.—Cocoa...	120	25.92	36.91	45.24	614.52
Toast.	28	3.22	.44	17.12	87.74
Cereal.	80	2.24	.40	9.20	50.32
10 a. m.—Egg nog	215	11.76	11.44	8.00	188.38
12 noon—Soup...	120	3.48	0.00	.60	55.56
Scraped beef...	37	8.36	103.00	0.00	43.91
Bread.....	42	4.07	.38	20.58	106.13
Butter.....	27	.28	23.80	0.00	222.82
2 p. m.—Cocoa...	120	25.92	36.91	45.24	416.52
Crackers.....	6	.21	.17	1.43	8.41
4 p.m.—Beef juice	96	4.70	.57	0.00	24.62
Milk.	190	6.27	7.60	9.50	136.23
6 p. m.—Rice.....	30	.84	.03	7.32	34.74
Custard.....	40	1.93	2.90	12.00	84.08
Egg.	45	6.48	7.04	0.00	73.66
Toast.	28	3.22	.44	17.12	87.74
8 p. m.—Milk....	190	6.27	7.60	9.50	136.23
10 p. m.—Milk...	190	6.27	7.60	9.50	136.23
Total	1794	127.71	254.83	221.85	2842.07

The nitrogen content of the urine alone is not a safe indication of the metabolism of the proteids of the ingested food, especially in the presence of a pathological process, such as a more or less active tuberculosis; for, as a rule, in direct proportion to the activity of the disease process the nitrogen output is increased, and thus it is not infrequent to find in the urine of such patients much more than sufficient nitrogen to represent the complete metabolism of all of the proteids ingested in the food. Of course the excess at least must represent tissue catabolism.

I am not aware that much has yet been published on this subject with especial reference to tuberculosis. Investigation to be of value here involves a more tedious and painstaking study of the feces in connection with the urine and food than is often convenient to make. Yet it seems to me the matter is of sufficient importance to justify thorough research.

Recently four infirmary patients, whose conditions indicated a two-hour diet like that described, not only failed to gain but actually lost weight in a two weeks' trial, notwithstanding that in each case the diet represented over sixty calories per kilo of body weight, and that the nitrogen content of the urine represented on an average the metabolism of over 86 per cent. of the total proteids of the food ingested. I give in the following table the individual record of these four patients:

Case.	Average Daily Proteid Consumed—Grams.	Average Daily Urea Output-Grams.	Estimated Average Daily Metabolized Proteids in Urine—Grams.
1	127.71	33.80	136.50
2	127.71	23.40	94.00
3	127.71	23.00	92.50
4	127.71	30.00	120.00

It will be seen that in case one of this group the nitrogen content of the urine indicated the metabolism of actually more proteid than was contained in the food, and case four almost an equal amount, yet this latter patient was without fever or other symptoms indicative of activity, although much underweight and with a very extensive lesion.

In all of these cases, if a careful examination of the feces had been practicable, it would no doubt have shown that not sufficient proteids had been metabolized from the food to give a plus nitrogen balance, notwithstanding the generous allowance ingested. In view of such experience one is tempted to accept the conclusions to be drawn from the remarkable experiments of Professor Chittenden and to apply them to the tuberculous invalid. But, much as I incline to the view that we have rather overestimated the value of proteids in tuberculosis, the question has not yet been sufficiently studied to justify any very radical departure from accepted methods.

It is quite impossible within the prescribed limits of this paper to consider in detail the many and various phases of the diet question as applied to the tuberculous invalid. It is certainly more than a question of calories, and it cannot be solved merely by arriving at theoretical standard amounts and relations of proteids, fats and carbohydrates.

The tastes, habits and peculiarities of individuals, even their heredity, are important factors. Variety, preparation and the manner of serving of foods are matters which have a bearing upon the success or failure of the treatment, and the psychotherapy, which must and does enter into all successful treatment of the consumptive, is more important in diet prescriptions perhaps than anywhere else. Every patient, and for that matter every physician, has his prejudices, one might almost say his fixed ideas regarding diet, many of which are founded upon insufficient bases of fact, and in proportion as they are stubborn and difficult to eradicate, they increase the complexity of the problem.

One patient declares that he cannot drink milk. Another that he

cannot swallow an egg. A third with an absurd uric acid phobia, insists that he cannot eat red meat. Fried foods are almost universally condemned, and our good friend, the pig, is fairly ostracized from good society in dietetic circles. I cannot but feel that in many cases these prejudices are ill-founded. Do not let us forget that the staunchest and sturdiest set of men and women which this country has ever produced have been raised to healthy maturity and have withstood the vissicitudes of disease and an ungentle climate on a diet of fried salt pork, potatoes, beans and breadstuffs, with fresh meat perhaps once a week. Fried sausage and buckwheat cakes with maple syrup for breakfast, carried no suggestion of dyspepsia to these good people, and they grew stout on apple pie and doughnuts, regardless of the question of proteids, fats and carbohydrates. But those good old days are no more, and even the New England farmer now inclines to a more critical attitude toward his food. He demands more meat, and there is no doubt that he has increased by nearly double the proteid content of his dietary. The question is "Is he a healthier animal for the change?"

Of all dietetic or medicinal agents employed in the treatment of tuberculosis, I believe there is none upon which more contradictory opinions and prejudices exist than is the case with alcohol. Even medical views upon this subject vary all the way from stern and uncompromising prohibition to extreme license.

It seems to me, that in this, as in all else therapeutic, arbitrary extremes may be fraught with danger from that of failure to employ a most valuable aid to cure on the one hand to that of fatal abuse of it on the other.

I am aware of the danger of being misunderstood in expressing an opinion indicating a middle course with regard to the use of alcohol in tuberculosis. Nevertheless, my experience leads me to hold such opinion. If the patient is doing well, has a good appetite and digestion, and is gaining weight satisfactorily without alcohol, certainly there is no excuse for prescribing it. But, on the other hand, where there is a tendency to anorexia, where digestion is sluggish, especially where milk is ill borne, where weight gain is not satisfactory, and of course where there is no specific contra-indication, I know of nothing else that will quite take the place of some of the light wines or malt liquors in promoting the building-up process for which we are striving.

In such cases, it is both a food, which is immediately available to the tissues, and a mild and harmless stimulant to digestion.

It must be taken in moderation, that goes without saying, but the dosage which may with propriety be employed will vary within wide limits in different individuals, depending upon temperament, education and idiosyncrasy.

As a general rule, to which of course there are many exceptions, light clarets, Rhine wines, or even Burgundy, may be advantageously permitted with mid-day and evening meals. To this list may be added the malt liquors, which are often preferred by patients, and such prescription need not in the least interfere with between-meal diets of milk and eggs. On the other hand, frequently the latter are much better borne when wine or beer constitutes the only beverage at meal time. Distilled liquors have a much narrower field of usefulness in the dietetics of tuberculosis, but are permissible in certain cases when alcohol is indicated and the more bulky forms are ill borne. In such cases there is little or no choice as to what kind shall be used other than is indicated by individual taste, but whatever is used should be well diluted.

Roughly estimating, I should think I have prescribed alcohol in some form as a dietetic measure in from five to ten per cent. of the tuberculous invalids under my care for the past fifteen years, and I confess I have never seen harm come from it in a single instance, while, on the other hand, I am sure that in many cases it has rendered invaluable service.

It would be little less than childish in this company to enumerate the many moral and physical contra-indications to the use of alcohol in the manner I have suggested. The physician who prescribes it without a thorough knowledge of his patient from every point of view is bound to meet with disastrous results occasionally. But employed judiciously and with watchful individualization, alcohol has a definite and well merited place in the dietetics of tuberculosis.

It is not within the scope of this paper to consider the subject of alcohol as a medicine, and what has been said applies wholly to its employment in the *dietary* of the consumptive.

In conclusion, one is forced to admit that in this matter of food for the tuberculous invalid, our teaching, up to the present time, has been largely empirical. Weight gains have followed heavy feedings, consequently the diet should be pushed to the limit of toleration. From

time to time, to be sure, warnings have been sounded against the danger of overfeeding, but they have been less heeded than would have been the case if they had originated from convincing scientific experimentation rather than from individual judgment, however good, based upon mere observation of gross phenomena.

To determine with any certainty the standard food requirements for tuberculous invalids, we shall have to make a more thorough study of metabolism than has yet, so far as I am aware, been done. It is not sufficient, as I have indicated, to compare the total nitrogen output of the urine with the total proteids of the food, but the feces must be analyzed at the same time in order to differentiate between endogenous and exogenous metabolism, and thus determine the amount of nitrogen required in the food to balance the pathological tissue catabolism. This means the clinical application on a large scale of the methods which have characterized some of the recent brilliant researches in physiological chemistry, and involves work practicable only in tuberculosis hospitals and sanatoria. A more careful inquiry into the whole subject, however, is assured when its importance is realized, for it must be conceded that it is not consistent practice to unnecessarily overburden the organs of digestion and elimination and at the same time to insist upon body rest. By all means let us determine the food requirements and meet them if possible, but by acquiring more accurate data on the subject avoid the dangerous error of overfeeding.

STATISTICS OF DIET IN SANATORIA FOR CONSUMPTIVES

By Irving Fisher, Ph.D.
New Haven

Hitherto, the chief weapons used in fighting tuberculosis have been fresh air and rest. But in such a desperate combat, every available weapon should be used—regularly graduated exercise, massage, hydrotherapy, mental diversion and suggestion, and last but not least, diet. Diet, however, while doubtless one of the most important agencies for the restoration of the consumptive's health, is also probably the most obscure and difficult of application.

The theories of diet in relation to tuberculosis are numerous and conflicting. Some authorities still cling to whiskey; most advocate meat, but there are a few whose experience has led them to discard meat; some emphasize the importance of cooking meat thoroughly, others maintain that it should be taken raw; eggs are recommended by some and rejected by others; and the same conflict of opinion exists even as to milk, potatoes, other vegetables, fruits, nuts, etc. There are those who have a theory that tuberculosis is first of all a disease of general malnutrition, and can be cured by a general diet aimed to restore the powers of digestion and assimilation; others maintain that for the cure of tuberculosis a *specific* diet is needed; for instance, blood serum, or mineral salts. Until recently, force-feeding was the rule. The wisdom of this, however, is now also called in question. It is usually assumed that the consumptive needs a large amount of proteid, but there are experiments which have tended to show that excessive proteid is injurious, not only to the healthy man, but even more so to the tuberculous invalid. Again, there is a belief that consumption is largely produced by the omission of fat from the diet, and is to be cured by inducing the patient to consume large quantities of emulsion. Others maintain that the aversion to fat which is alleged to precede consumption, if it exists, is due to a deficiency of gastric juice, and

that the consumptive instinctively avoids fat because it tends to restrain the secretion of such small amount of juice as the stomach is able to produce.

It is evident, therefore, that the subject of diet in tuberculosis requires much study. The present writer disclaims any special knowledge, and the present paper aims merely to present statistics of existing methods collected for comparative purposes.

Letters of inquiry were sent out to ninety-five of the leading sanatoria of the world, of which sixty-three were in the United States, two in Canada, thirteen in Germany, eleven in Great Britain and the remainder in France, Austria, Norway, Switzerland and Russia.

Very few supplied any measured data; in most cases the statement of the food consumed was given only in a general way. The following two tables give the data received which are not in measurable form, so far as they seem in the least noteworthy. Some remarks have been omitted in the belief that those from whom they came might object to seeing them in print. Two sanatoria (one American and one German) replied that they could not regulate their patients' diet because their patients were able to pay well and expected to get what they wanted to eat! Some sanatoria which replied are omitted owing to the fact that their replies contained no data.

On the other hand, a considerable number of sanatoria had made an exact record of the diet used, or kindly took the trouble to do so expressly in order to answer the writer's questions. On the basis of these measured data the third table has been calculated, in which are incorporated also such measured data as the writer has chanced upon in various publications.

The first comment which naturally occurs to one who reads these three tables is that in most cases the foods employed are simply the foods in common use in the country or place where the sanatorium is situated. Almost any article of food, however deleterious in the estimation of physiologists, can be found in the lists supplied, such, for instance, as wine, beer, vinegar, pickles, catsup, fried food, pork, sausage, tripe, tea, coffee, gingerbread, pastry, etc. On the other hand, some of the sanatoria have taken particular pains to exclude foods regarded as deleterious, or to make extensive use of foods regarded as specially beneficial, aside from milk and eggs, which are of course a very common mainstay. Thus, a few make special use of nuts and fruit; others, cod liver oil; others, Russell Emulsion, peptol, corn

TABLE I.—UNMEASURED DIET (AMERICAN). (ARRANGED IN ALPHABETICAL ORDER OF LOCATION.)

Institution.	Location.	Physician in Charge.	Food.	Meals.[1]	Remarks.
Maryland St. Hosp.	Baltimore.	Louis Hamman.	Ordinary.	3(+2)	"As liberal supply as they can manage."
Montefiore Home.	Bedford Sta., N. Y.	L. Rosenberg.			Moderate force-feeding.
Boulder Sanit.	Boulder, Col.	W. H. Riley (formerly). (No longer takes tbc. cases.)	Meat seldom.		High proteid. Moderate calories. Meat only when other proteid not relished. Usually those who tired of other proteid also tired of meat.
Kings Co. Hosp.	Brooklyn, N. Y.	J. F. Fitzgerald.	Ordinary.		Some force-feeding.
Brooklyn Home for Cons.	Brooklyn, N. Y.	E. Reynolds.			All stages. Uses oils combined with corn syrup, gets more wgt. gaining than when uncombined.
Nordrach Ranch.	Colorado Springs.	Jno. E. White.	Milk the staple.		Force-feeding. One man took 29 glasses of milk a day.
Pembroke San.	Concord, N. H.	H. T. Fontaine.			Force-feeding.
Nat. Jewish Hosp.	Denver, Col.	M. Collins.	Ordinary (much fat).		Reaction against force-feeding, causes stomach trouble. Individualizes.
Y. M. C. A. Health Farm.	Denver, Col.	Jno. Wethered.			Opposed to force-feeding.
Hotel Dieu (Sisters' Hosp.)	El Paso, Tex.	Outside physicians.	Ordinary.		
U. S. Gen. Hosp.	Ft. Bayard, N. M.	Geo. Bushnell.	Ordinary.		Amount consumed limited only by capacity and desire.
Sanit. Gabriels.	Gabriels, N. Y.	W. H. Clancy.	Ordinary.	3(+3)	Force-feeding.
Muskoka Cottage San.	Gravenhurst, Ont.	J. H. Elliott.			"We constantly see cases of tuberculosis in which there is a steady gain in weight from week to week, tho' a very small amount of food is taken."
Muskoka Free Hosp.	Gravenhurst, Ont.	E. D. Parfit.	Ordinary.	3(+2)	
State Hosp.	Howard, R. I.	F. B. Jewett.	Ordinary.		Moderate force-feeding.
Stony Wold San.	Lake Kushaqua, N. Y.	H. S. Goodell.			Mixed diet; preponderance of proteid and fat.
Loomis Sanit.	Liberty, N. Y.	Dr. King.	Ordinary.	3(+3)	Considerable fruit. Few nuts.
Pottenger San.	Monrovia, Cal.	F. M. Pottenger.			Reaction against force-feeding.
South Mt. Camp. San.	Mount Alto, Pa.	A. M. Rothrock.			No restraint on amount of food. Believes, however, in limiting proteid.
Riverside San.	N. Y. City.	H.S.Westmoreland.	Ordinary.	3	Unlimited use of eggs.
Seton Hosp.	N. Y. City.	E. C. Garlock.	Uses beer.	3	
St. Joseph's Hosp.	N. Y. City.	C. M. Cauldwell.		3(+2 or 3)	Includes cod-liver oil and Maltzyme.

[1] The numbers in parentheses are extra lunches additional to regular meals. These extra lunches usually consist of milk and eggs.

TABLE I.—UNMEASURED DIET (AMERICAN). (ARRANGED IN ALPHABETICAL ORDER OF LOCATION.)—*Continued.*

Institution.	Location.	Physician in Charge.	Food.	Meals.[1]	Remarks.
Grand View Inst. for Cons.	Oil City, Pa.	H. E. Kirshner.		3	Average diet consists of 6 or 8 raw eggs, 2 qts. milk and full meal at dinner time. Patients often gain better upon three meals than when the two lunches are added. Also some gain better taking 6 eggs than when they have been given as high as 16 in a day.
Ottowa Tent. Colony.	Ottawa, Ill.	J. W. Pettit.	Ordinary + nuts.	3(+3)	Applies domestic science and balanced bills of fare.
R. I. State San.	Pascoag, R. I.	H. L. Barnes.	Ordinary.	3	
Phila. Gen. Hosp.	Philadelphia.	Wm. B. Stanton.			Much liquid; 3 qts. milk, 6 raw eggs and 1 full meat meal daily.
N. Y. State Hosp.	Ray Brook.	Burnham.			Force-feeding.
Mass. State Sanit.	Rutland, Mass.	W. J. Marclay.	Ordinary.	3(+3)	Reaction against force-feeding.
West Mt. San.	Scranton, Pa.	J. M. Wainwright.			Force-feeding.
Sharon Sanit.	Sharon, Mass.	W. S. Griffin.			Moderate force-feeding.
New Mexico Cottage San.	Silver City, N. M.	E. S. Bullock.		3	Least to gain weight, ideal is 20 lbs. above normal, av. gain 30 lbs. High nitrogen. Reaction against over-feeding, individualizes.
Mt. St. Rose San.	St. Louis, Mo.	Wm. Porter.	Ordinary.		Individualizes.
Washington Asylum.	Washington, D. C.	L. F. Zinkhan.		3	Much fat.
Sunnyrest San.	White Haven, Pa.	E. Stockdale.	Ordinary + fruit and nuts.	1(+5)	Large gains in weight. Finds that any one can take milk and eggs granting they are the right quality.

[1] The numbers in parentheses are extra lunches additional to regular meals. These extra lunches usually consist of milk and eggs.

TABLE II,—UNMEASURED DIET (FOREIGN). (ARRANGED IN ALPHABETICAL ORDER OF LOCATION.)

Institution.	Location.	Physician in Charge.	Food.	Meals [1]	Remarks.
Tonsaasen.	Christiania, Nor.	Andvord.			Against force-feeding. Patients should "reduce outgo instead of increase income," *i. e.*, rest instead of overfeed.
Turban's San.	Davos-Platz, Switz.	S. Turban.			Force-feeding.
San. Brehmer.	Goerbersdorf, Ger.	Von Hahn.		5	
Institut. für Pharmakol. und Physyiol. Chem.	Rostock, Ger.	R. Kobert.			Force-feeding. Proteids and fats.
Römpler's San.	Goerbersdorf, Ger.	Th. Römpler.			No restriction in diet.
San. Grand Hotel.	Leysin, Switz.	Echaquet.			Seen many digestions ruined by over-feeding, yet patients without appetite should be urged.
Mt. Vernon Hosp.	London.	T. N. Kelynack.			Individualizes.
Nordrach Colonie.	Nordrach, Ger.	Otto Walther.			Minimum diet for wt. gaining. Individualizes. Some hardly any meat, others much. "Av. $\frac{1}{3}$ meat and albuminous, $\frac{1}{5}$ fat, $\frac{3}{5}$ farinaceous, ordinary diet about 15 per cent. proteid, 35 per cent. fat."
Kremser San.	Sulzhayn.	Kremser.	Ordinary.	3(+2)	"I absolutely disagree with the general superalimentation practised in many sanatoriums—my experience proves that an over-feeding has not the least favorable effect in weight gaining, but that the chief point is to keep the proper balance in the composition of the diet, *i. e.*, proteids, fat and carbohydrates, like 1:3 resp. 1:4½.
	St. Petersburg, Russia.	Simon de Unterberger.			Much meat; opposed to diet regulation.

[1] The numbers in parenthesis are extra lunches additional to regular meals. These extra lunches usually consist of milk and eggs.

TABLE III.—MEASURED DIET. (IN ORDER OF QUANTITY OF FOOD USED.)

Institution.	Location.	Physician in Charge.	Foods.	No. of Meals.	Proteid.	Fat.	Carbo-hydrate.	Total Calories.	Remarks.
Roten Kreuz San.	Grabowsee, Ger.	Werner.			1200	2200	2100	5500	
Maine San.	Hebron, Me.	Estes Nichols.	Ordinary.		840	1900	1640	4380 at first	Does not include extra eggs and milk.
					500	1200	1600	3300 later	
Post Graduate Annex.	N. Y. City.	John F. Russell. For rest treatment only milk, bread, butter, emulsion and vegetable juice. In all cases excludes alcohol, tobacco, tea, coffee, chocolate, cocoa, beef-tea, meat extracts, meat juice and vinegar.			510	2165	1565	4240	Average diet under rest treatment. Uses glycerine, calcium chloride and cathartics systematically; ambulant cases use more food. In selected cases omits meats.
Rekneas San.	Kristiania, Norway.	Edw. Kaurin.			820	1860	1470	4150	
Royal Nat. Hosp. for Cons.	Ventnor, Isle of Wight.		Ordinary.		700	1660	1640	4000	Average diet.
Agnes Memorial San.	Denver, Col.	G. W. Holden.	Ordinary.	3	830	1665	1470	3965	Greater gains of weight on 3 than on 5 meals.
Reception Hosp.	Saranac Lake, New York.	E. R. Baldwin.	Ordinary.	3+(2)	650	2000	1250	3900	
Millet San.	East Bridge-water, Mass.	C. S. Millet.	Ordinary.	3	600	1500	1450	3550	Average 4 days one patient.
Gaylord Farm San.	Wallingford, Conn.	D. R. Lyman.		3	530	1480	1540	3550	No force-feeding except in special cases. Most are restrained from over-eating. Average gain in weight of the 10 discharged cases whose average diet was given was 19 lbs. in from 3 to 6 months, varying from 13 to 22, proteid from 340 to 630, fat from 1100 to 2000 and the calories of the ten varied from 2700 to 4100. Those 10 cases were heavier eaters than the average. They had 3 meals and one or two glasses of milk between meals. No extra eggs. Seven were males, 3 females, 5 were at or above their normal weight when discharged (by insurance tables), five below.

TABLE III.—MEASURED DIET. (IN ORDER OF QUANTITY OF FOOD USED.)—*Continued.*

Institution.	Location.	Physician in Charge.	Foods.	No. of Meals.	Proteid.	Fat.	Carbohydrate.	Total Calories.	Remarks.
Pine Ridge Camp.	Providence, R. I.	W. H. Peters.	Ordinary.		900	1700	900	3500	Fairly early weight gaining cases.
U. S. Pub. Health & Marine Hos. Ser.	Ft. Stanton, N. M.	P. M. Carrington.			650	750	1900	3300	Based on standard diet of U. S. Health & M. H. Ser. with addition of milk and eggs.
Stadt. San.	Munich.	Filler.			570	1130	1570	3270	If necessary.
			Ordinary.		500	1320	1230	3050	Jour. of Outdoor Life," Jan., '06.
		Goodbody, Bardswell & Chapman.			480	1300	1220	3000	Most suitable diet for tuberculosis Med. Chir. Trans. Vol. 84, 1902, pp. 119, 120.
			Nuts, fruit and grains, exclusively.		370	870	1600	2840	Proposed in "Good Health" 1905, by Dr. Herbert Ossig.
San. Falkenstein.	Falkenstein, Ger.	Besold.			530	1120	1050	2700[1] 3400[2] 2000[3]	Opinions on superalimentation agree with Dettweiler his predecessor. Chief aim should not be to make patient as fat as possible, and "one never can expect a patient to be the more resistant to disease the fatter he is or becomes." Superalimentation only needed to compensate the loss of proteids and fats; especially needed in feverish cases. In later cases much fat given. In other cases individualizes the diet by weighing the patient.
Winyah San.	Asheville, N. C.	Von Ruck.	Ordinary.					2500	Digestive complications determined by laboratory examinations. For weight gaining fats and carbohydrates predominate.
		Burton-Fanning.	Ordinary, few vegetables.	3+(3)	500	1100	900	2500	See "Open-Air Treatment of Tuberculosis."
Brompton Hos. for Cons.	London.	Williams.	Ordinary.		410	820	1170	2400	Average diet.
	New York.	W. H. Porter.	Excludes potatoes, cereals, fruit, nuts, pastry, most vegetables, soups.		610	970	560	2140	"American Medicine," September 20, 1902.

[1] Average. [2] Maximum. [3] Minimum.

syrup and oil, malted nuts, maltzyme, vegetable juices. Most institutions probably make a point of excluding alcohol, others bar out tobacco, tea, coffee, chocolate, cocoa, beef tea, meat extracts, meat juices and vinegar; a few exclude meat, and one combines with his force-feeding a systematic use of cathartics.

In regard to the question of the quantity of food consumed, out of the sixty-four cases tabulated, twenty-eight were distinctly in favor of the system of force-feeding, and twenty were distinctly reactionaries against it. Among the latter are some of those who have had the widest experience. In the table of measured data it will be seen that the dietaries range all the way from 2,100 calories to 5,500 calories,—a range of 160 per cent.

Naturally, not all of these standards can be correct, and if we are to believe that there is any virtue in "physiological economy" we must conclude that those sanatoria which use the lowest standards consistent with weight-gaining must be more nearly on the right track. It may well be, however, that the minimum standard used in one sanatorium could not be employed in another without a corresponding change in the character of the foods used, or in the proportions of proteids, fats and carbohydrates. One physician who has done much intelligent experimenting found that less food was necessary when bread and butter were added to a diet which previously had consisted of milk and fats exclusively. Two report that patients often gain better on three meals than five or six, and one states that six eggs a day often produce better gains than sixteen. In one case, the patients are usually advised against eating as much as they would if left to their own devices. The weight-gains in this place average nineteen pounds in from three to six months. In this same institution it has been found that a prime factor in weight gaining is the palatability of the food.

On the basis of the tables, we may feel considerable confidence that, given proper foods and proper proportions of food elements, the average tuberculous patient can be successfully nourished on 3,000 calories per day, or less; in other words, *on no more than is usually consumed by the ordinary sedentary man.* It is also extremely probable that seldom can less than 2,000 calories be employed without loss of weight. There will doubtless be found considerable variation between 2,000 and 3,000, due to differences in the weight of the patients, differences in activity, powers of assimilation, and the extent of the disease.

Hitherto, there has evidently been too much ambition to produce

large gains in weight. This ambition is doubtless responsible in large measure for the extremes to which over-feeding has been practiced. Weight-gaining, purchased at the cost of strain on the physiological machinery, is of very doubtful value, and it may be especially questioned whether the over-feeding practiced *during convalescence* or after the patient is apparently cured, cannot be entirely dispensed with. The experiments in England of Doctors Goodbody, Bardswell and Chapman show that over-feeding healthy individuals produces weight-gaining, but injures their health and fitness for work. The comment of an observing physician to the writer on patients discharged from a large and celebrated sanatorium was that they were fat, but weak.

It has hitherto been the fashion to advise patients when leaving a sanatorium to maintain their weight above the normal, the belief apparently being that the surplus would stand them in good stead in case of a relapse. But it may well be that relapses themselves are made more probable by the attempt to maintain and carry surplus weight, and the consequent daily tax on the powers of digestion and assimilation to maintain this unnatural state. Assuming that the observations of Goodbody, Bardswell and Chapman apply to the discharged patient, we may well ask whether the attempt to maintain their weights above normal is not a chief cause for the tendency of the disease to recur. The discharged patient, ambitious to resume his former work, must be considerably handicapped by attempting at the same time to remain fleshy, especially if, as is usually the case, his digestive powers are naturally weak. His working power must needs be impaired, and the danger of working beyond his strength is naturally increased. One patient for two years after his first attempt to resume work following recovery from tuberculosis was decidedly below par in his working efficiency. It was only after practicing the "physiological economy" demonstrated and advocated by Professor Chittenden, and losing twenty pounds of useless weight, that he was able to reach or surpass his former working power.

This physiological economy does not, however, consist entirely, or even principally, in the reduction of the total food value. Professor Chittenden has shown that the dietetic sin of the ordinary healthy man consists principally in too high a consumption of proteid, and the question arises whether the same may not be true in the treatment of tuberculous invalids. The evils from using excessive proteid, in the case of healthy men, have been very thoroughly proven by the work of

Professor Chittenden. The present writer has also confirmed them by a collection of statistics gathered from physicians, physiologists and experimenters with diet to the number of many hundreds of cases. Among these are included a squad of nine students at Yale who have been experimenting on this line. Their experience shows that physical and mental endurance are usually increased by a reduction in the amount of proteid ordinarily consumed.

In the case of the tuberculous invalid, the proteid required is evidently greater than for the healthy man. Tuberculosis, being a wasting disease, should naturally require much material for repairs. But the work of Chittenden and Folin has shown that the proteid requirement is so much within the ordinary proteid consumption, that even were it found that the tuberculous invalid *requires* double or treble the amount *required* for a healthy man, he would still be far from requiring the amounts which are often fed to him. The tables which have been presented show a wider range in the amount of proteid used than even in the total calories. The proteid ranges from 370 to 1,200 calories. The lowest of these is beyond the Chittenden requirement for the healthy man, which for a man weighing 140 pounds is about 210.

Hitherto there have been very few experiments to determine what the effect of an increase or decrease of proteid may be on the tuberculous patient. In one case a physician who had been feeding a patient 3,000 calories a day, of which about 350 were proteid, found that the patient's symptoms improved under this diet, though his weight did not increase. Desiring to effect an increase of weight he attempted to increase the proteid, but this change instead of producing weight-gaining, seemed to raise the patient's temperature. Dr. J. H. Kellogg, of the Battle Creek Sanatarium, believes in a minimum proteid, about two ounces, or three in some cases (240 to 360 calories) because (1) consumptives often lack gastric juice and pepsin, (2) proteid in excess is quickly oxidized and adds to fever if already present, (3) proteid in excess leaves waste products, and (4) proteid in the form of meat has toxins already formed.

If the principle of physiological economy is sound, the minimum proteid which will produce the necessary repairs is the best amount to be administered. Anything below this minimum will of course lead to disaster. Physicians have rightly tried to be on the safe side, but have usually left a much larger margin of safety than is necessary.

Burton-Fanning says that the secret of feeding the consumptive is

summed up in the word "accuracy." To obtain this accuracy—to achieve physiological economy and at the same time full nutrition—a careful and measured study of diet is needed. Fortunately, to-day such measurement is possible, and far easier than a few years ago. The present writer has attempted to show, in an article in the April number of the *American Journal of Physiology,* a simple method by which a patient's diet may be recorded and regulated without any personal annoyance or anxiety on his part.

An examination of the preceding tables will show that not only proteid but also fat and carbohydrate vary widely. In one case the fat alone amounts to 2,200 calories, or as much as the total food in some institutions. In another case it is as low as 750.

When the questions of the quantity of food and the proteids, fats and carbohydrates are settled, there will remain the question of what kinds of food are best. We need facts as to the effects on tuberculosis of alcohol, tobacco, tea, coffee, pepper, vinegar, spices, oils, emulsions, vegetable juices, and even meat, eggs and milk. Not one of these should be accepted as the best or as a universal food in tuberculosis, except provisionally.

The question of meat is closely bound up with the question of proteid, for the quantity of proteid will usually vary with the quantity of meat. But meat should also be considered apart from the question of proteid. It would appear that the sole virtue of meat not possessed by other ordinary proteid foods, lies in the fact that it is highly peptogenic. Pawlow found that meat was more highly peptogenic than any other food with which he experimented. Chemical analysis has shown that meat is deficient in mineral salts, that eggs, milk and vegetables contain more iron, as well as all other minerals, than does meat.

The suggestion that meat possesses a serum virtue specific in the treatment of tuberculosis is apparently as much without experimental verification as, a few years ago, the suggestion that urea is a specific in tuberculosis. In respect to digestibility, certain other forms of proteid, such as gluten, are superior to meat. The peptogenic virtue which meat possesses is evidently very greatly in its favor, especially in the treatment of tuberculosis. But the opponents of meat point out that the peptogenic effect is secured at the expense of introducing into the system poisonous waste products. It would seem to follow from this that if a sufficient stimulus to the secretion of gastric juice can

be secured without the use of meat, there will result physiological economy.

If meat is to be used, a subsidiary question arises whether it should be cooked or raw. Richet and others have advocated raw meat, and have seemed to base their conclusions on experimental evidence, but the check experiments of Dr. Brown at Saranac Lake have failed to confirm Richet's conclusions.

Finally, it is doubtless of the highest importance to individualize the diet. This has been emphasized in many of the replies, though, oddly enough, some who have most emphasized the necessity of individualizing the diet have urged it as an argument against a measured dietary. It is of course true that if an accurate adjustment of diet to individual needs is to be sought, even greater importance attaches to the measurement of diet than would be the case if a single diet would suffice for all patients. In order to suitably adjust the diet to particular idiosyncracies of the individual, the sanatoria might do well to make a systematic use of gastric analysis, in order particularly to determine the amount of secretion of hydrochloric acid and pepsin. The results would give the physician a clue as to whether the patient needs a large amount of fat to repress the acid secretion, or will do better by substituting carbohydrates because of a deficiency, and also to what extent it is necessary to stimulate the formation of pepsin by means of peptogenic foods, such as meat and sweets.

But after all the measurements and adjustments have been made for the patient, it is doubtless true that much must be left to his own taste. The greatest service the physician can perform for his patient in the matter of diet is to normalize the food instinct so that the patient can be trusted to select his own food correctly. To this end it is suggested that experiments be made on patients in careful mastication in order that the taste may be given a longer period in which to judge as to its likes and dislikes. It was on this basis that the writer experimented on the squad of nine healthy Yale students. In their case the result in ten weeks was an instinctive lessening of proteid, especially in meat form and an increase in endurance as shown by gymnasium tests, amounting to over 50 per cent.

We conclude that there is as yet very little known with certainty as to the most efficient diet in the treatment of tuberculosis, or the extent to which the diet must be individualized. In order to determine

either the standard or individual diet much study and accurate observation are needed.

Hitherto, with a few notable exceptions, sanatoria have merely imitated the home table. But it is unscientific to follow current custom in food, and may be quite as disastrous to the patient as to follow current custom in ventilation. It is equally unscientific to follow dogmatic opinion of authorities, however eminent. No science ever made progress which depended on opinions. The only tribunal in true science is the tribunal of facts, carefully arranged and sifted.

It will undoubtedly happen that in the next few years sanatoria and laboratories will provide the necessary observations. These observations should include observations on the consumptive's diet before entering sanatoria. Such data are now being collected by one institution and will serve to determine the question whether fat is rejected by consumptives as a rule. Then the question of diet will be raised out of the realm of opinion to the plane of verified fact.

DISCUSSION ON PAPERS BY DR. KING AND PROFESSOR FISHER

Dr. H. P. Loomis, New York: I have been asked to discuss Dr. King's paper. There are so many good points in it that I hardly know where to begin. Two or three statements he has made, however, especially appeal to me; for instance, the last one where after going very thoroughly into the chemical and physiological value of food and leading us almost to think he is going to decide the question scientifically, he makes the statement: "The diet question in tuberculosis is certainly more than a question of calories and it cannot be solved merely by arriving at the theoretical standard of the amount and relation of proteid fats and carbohydrates." On this point I agree with him most emphatically. The scientific investigation of food value no doubt is of practical importance when we are considering normal individuals, but I do not believe we will ever reach practical results along this line in tuberculosis. The matter of diet, as Dr. King has suggested, is an individual standard rather than a class of disease standard. The kind of feeding that will accomplish results in one individual with apparently the same pulmonary involvement and constitutional traits will fail absolutely in another. The dietary treatment of tuberculosis is based on the same principle so important in the treatment of other diseases. It is the treatment of each special individual based upon experience and careful judgment.

CLINICAL SECTION

Dr. King has struck the keynote when he says, "Diet is not a question of the latent heat value of fuel put into a furnace, but the completeness of actual combustion upon which depends the energy derived." Ever since I have adopted the plan of treating all acute cases of tuberculosis with high temperature and markedly destructive lesions exactly as I should a case of typhoid fever with two hours of feeding milk almost exclusively and often small doses of whiskey in the milk, I have been surprised how often and quickly the character of the case changes. Milk is the one food that can be absorbed without disturbance under these conditions. I wish Dr. King had gone a little more in detail into the subject of alcohol in tuberculosis. It is always an interesting subject and one in which there is a good deal of difference in opinion. In my belief we will encounter very few cases of phthisis which are not benefited at some period of their course by the discreet administration of alcoholic stimulants. I believe alcohol is one of those remedies which is capable of doing good if judiciously used, while at the same time it is as liable to do positive harm. I never use it in the *first stage,* excepting sometimes in the form of a glass of ale or porter twice a day with meals, given with the object of increasing the appetite and aiding the assimilation of food. I have often seen marked increase in weight under its use in this class of cases, and in this form. By mixing porter with lime water in equal parts it can always be taken even by the most sensitive stomachs.

In the *second stage* I only use it in small quantities with food, preferably in the form of a milk punch in the forenoon or on retiring.

The *third stage* is the one in which alcohol appears to do the most good when taken in small quantities and repeated at regular intervals—in the acute cases and in the chronic and febrile cases taken with meals well diluted.

To-day we have adopted *four* general means with which to combat and cure pulmonary tuberculosis. *Climate,* represented by pure air; *food, constant medical supervision* and *medication,*—all things being equal. Judicious feeding is the most potent, although I think constant medical supervision comes very close to it in efficiency. Climate avails little when the patient is daily losing ground because of unassimilated food. Medication may be worse than useless because of enfeebled digestion. In all cases of successful treatment of phthisis attention to diet is of paramount importance. Climate and medicine are secondary. Our success in improving nutrition by what is known

as the dietetic treatment of tuberculosis will depend not as many believe upon the personal digestive possibilities of the patient, but as much on the amount and type of the febrile state which accompanies the malady. It is during the periods of febrile remissions that come to every case that we make the greatest gain in food assimilation. I would say that all consumptives pass through three distinct stages in regard to their digestive powers.

First.—The period during which digestion and appetite are unaffected.

Second.—The period from the time when gastric disturbance first begins until the stomach refuses solid food. During this time septic infection is more or less constant, the fever intermittent, and loss of flesh generally progressive.

Third.—The period from the time when solid food can no longer be taken without digestive disturbances until the death of the patient. Again along this same line we might divide our tubercular cases as far as prognosis is concerned into two classes.

First.—Those whose digestive condition is perfectly normal or those apparently having bad digestion who soon pass into the normal class if painstaking care and attention is given to their diet and intestinal condition. In this class the prognosis in my experience is exceedingly good, even often with extreme pulmonary involvement.

Second.—The second class is the one in which the prognosis is always bad and is represented by those individuals whom it is impossible to "feed up" and to correct their constantly recurring digestive disturbances no matter what care we use. Some invalids of this class will *apparently* assimilate an unusual quantity of food for a week or so and then suddenly their digestion fails and sooner or later it is impossible to handle them at all dietetically. I am a great believer in three articles of diet in pulmonary tuberculosis—milk, meat and fats. We all know that milk and meat are the two articles which in themselves furnish the greatest amount of heat and power producing elements with the least expenditure of digestive energy. That milk and meat may be taken in sufficient quantity and during a long enough period to produce good results, they must be modified and varied to suit the individual case. Here is where the intelligence and care of the physician are put to the test. There are a number of ways that milk can be taken; one good rule to make is that it should never be taken in quantities exceeding eight ounces at a time and then should

be swallowed very slowly. One of the most palatable ways in which milk can be administered to tuberculous patients is scalded with seltzer water added. This mixture is particularly refreshing in the early morning and markedly aids the morning cough and expectoration. If this can be taken regularly before the patient leaves the bed, a marked improvement will often be noted in strength and appetite. I am a great believer in peptonized milk when the digestive powers are especially weak. It can be assimilated in large quantities and its taste, which is unpleasant to some, can be modified by a little cocoa. Butter-milk, which is as nutritious as milk, is often a very acceptable form of furnishing fluid and nourishment to some.

One word in reference to meat. It is difficult for many tubercular patients to eat with their meals any large quantities of meat but it will be found that very large quantities can be taken in a form most readily assimilated if given in one of three ways. Either as freshly squeezed beef juice or as scraped meat balls; broiled over a quick fire and served hot with pepper and salt. Or the scraped meat may be given raw, spread between thin layers of bread. To some this is a very appetizing method. Again as meat powders; there are a number on the market prepared especially for forced feeding. These powders can be added to milk, a milk punch or to soup, or may be taken in cold or warm water. The object of giving meat in the various ways I have suggested is to give the largest amount of albuminoids in a small compass in the most palatable form and in a way that will not disturb the stomach. It is well known that muscle-fibre is a loose combination of albumin and fat, and that fat is a component factor in all muscular histogenesis. So in phthisis fat is necessary to the building up of healthy tissue, and the dietary should be as rich in fat as the assimilative powers of the patient will allow. The greatest evidence of the value of fat in the food of phthisical patients is furnished by the universal confidence placed in cod-liver oil as a curative agent. It is only the best form of fat because it is the most easily assimilated of all, and can frequently be absorbed when no other fat can be. Nature supplies an oil emulsion in milk, and this largely explains its excellent effects. Cream may be used when it is desirable to introduce fat into the system. It has, however, to be given with care, as in many persons it produces dyspeptic symptoms which may often be obviated by taking it with a little liqueur, such as maraschino or chartreuse, or mixed with aerated water in the proportion of a teaspoonful to a

glass. I believe tubercular patients should be urged to take as much butter as possible.

What I have said about milk, meat and fat in the diet of tubercular cases may not apply to the sanatorium cases which Dr. King and Dr. Fisher have been considering, but I certainly think they are the most valuable dietetics we have in treating cases at home. There are two distinct innovations that have come into vogue in the treatment of tuberculosis the past few years. I feel that they are agents which under suitable conditions are of great value, but under the conditions the majority of tubercular people are forced to live, they are responsible for great harm and for many deaths. I refer to sleeping out of doors and consuming large quantities of raw eggs. When I have been to the sanatorium at Liberty and seen the patients taking, besides their regular meals, a dozen or more raw eggs a day, I have marvelled—how their digestive processes could stand it. I don't think any of us would care to do it. I know this plan of feeding is successful in patients living an out of door life in the country, but I know just as well that consumptives in our cities cannot take raw eggs in any quantity for any length of time without causing grave digestive disturbances. I know there are exceptions to this rule, but this applies to the vast majority of cases, and the sooner the medical men who are treating cases at home recognize this and do not follow blindly the suggestions made by physicians under entirely different local conditions, the better it will be for their patients.

I have adopted the following general rules in feeding:

1. Food should be taken at least six times in the twenty-four hours; light repasts between the meal and on retiring.

2. Never to eat when suffering from bodily or mental fatigue or nervous excitement.

3. Take a nap or at least lie down for twenty minutes before the mid-day and evening meals.

4. Take only a small amount of fluid with the meals.

5. The starches and sugars should be avoided, as also all indigestible articles of diet.

6. As far as possible, each meal should consist of articles requiring about the same time to digest.

7. Only eat as much as can be easily and fully digested in the time allowed.

8. As long as possible systematic exercise should be taken to favor

assimilation and excretion; when this is impossible massage or passive exercise should be undergone.

9. The food must be nicely prepared and daintily served; made inviting in every way.

Dr. John W. Brannan, New York: I feel somewhat embarrassed by the scientific character of the company in which I find myself to-day. When our chairman, Dr. Bowditch, asked me some two months ago to take part in a discussion of "Diet in Tuberculosis," I did not expect to be called upon to discuss proteids and food values and heat calories. Being at a loss as to what I could say of interest on these subjects, I turned to my friend, Dr. Knopf, who always comes to my aid when I am in difficulties, especially those of a tuberculous nature, and he suggested that perhaps the section might like to hear of the kind of food that we give the children in the hospital at Sea Breeze, Coney Island. The following is an average daily bill of fare:

Breakfast.—Boiled rice with milk and sugar, two helpings; minced beef with potatoes, one to two helpings; bread and butter, two to four, or even five slices; one to two glasses of milk.

Dinner.—Stew made of fresh beef and lamb, with carrots, onions and tomatoes; mashed potatoes; bread and butter, two to three slices; milk, one to two glasses; tapioca pudding.

Supper.—One egg; buttered toast, two to five slices; stewed peaches; milk as at breakfast.

In addition the children have a light luncheon of bread and butter or crackers and milk at ten o'clock, and fruit or crackers and milk at three o'clock in the afternoon.

This diet table, as you may see, is not arranged scientifically, but was prepared by the superintendent of the hospital, who, in addition to her great ability as an executive officer, is also an excellent cook. You will probably be struck with the very large amount of food these children eat, and yet it cannot be called forced feeding, if we are to understand by that term food that is forced upon the patients. I have made a rough calculation of the heat values of the food consumed in one day by each child, and it comes to about 2,500 calories. As the children do not average in weight more than twenty kilos, this would give to each child about 125 calories per kilo, an amount greatly in excess of the highest given in the table prepared by Dr. King. The ability of the children to eat and digest and assimilate so much food is probably

due to their living out of doors throughout the twenty-four hours. The appetizing manner in which the food is cooked and served should also be taken into account. It is probable also that the digestion of a child suffering with surgical tuberculosis is not so easily disturbed as that of a person suffering with pulmonary tuberculosis. We give no alcohol to the patients at Sea Breeze. In England, at all events at Margate, it is customary to give beer, and I think it probable that in France, and possibly in other continental countries, wine may be given to the children.

Dr. S. G. Bonney, Denver: After hearing the last remarks in endorsement of super-alimentation in tuberculosis, I am glad to know that I am not in the hopeless minority. I was interested to listen to both papers, which I believe to be valuable contributions to the subject under discussion. They have emphasized a certain very important point, namely—the dangers of indiscriminate over-feeding. I should like also to call attention to the dangers attending patients who select their food without a physician's supervision. It cannot be that there is any difference of opinion regarding these subjects. We are all aware that people develop tuberculosis even when there is little loss in weight. There may be disturbed metabolism, but no other actual impairment of nutrition. This must not be considered, however, as an argument against super-alimentation. I am not prepared to discuss this subject from the physiological standpoint, but only from my own experience. I have seen many cases of tuberculosis, and most of these have been far advanced. As I have pointed out in another paper read before this Association, the cases arrive in Colorado late in the disease. The large majority have active trouble in both lungs; more than half present evidences of severe constitutional disturbance, including symptoms of severe septic infection. It must follow that these cases are of such a nature that they will not tolerate any very great negligence or inaccuracy in treatment, and it is true that if the results are satisfactory in such desperate cases the treatment must have been fairly rational. It so happens that the results have been more than satisfactory. This affords a justification to me for presenting another side of the subject, and I feel that to a great extent the results accomplished have depended upon the management. (See following paper.)

Professor Irving Fisher, New Haven: While I do not believe that patients should be left to their own devices in the sense that they should

prescribe for themselves, for my part, I should like to see the experiment tried of leaving patients to their own devices in the sense that they should *follow instinct.* In one sanatorium patients are advised to take as much or as little as they choose, and they show gains as high as nineteen pounds in three months. If patients could be induced to eat *slowly,* observations made upon them might yield a valuable contribution to our knowledge. In this connection I have myself tried the experiment of thorough mastication on nine healthy students at Yale. By means of a " Mechanical Diet Indicator " a record was kept every day of the food taken for a period covering more than three months. Gymnasium tests showed an increase of muscular endurance of fifty per cent.

DIET IN PULMONARY TUBERCULOSIS

By Sherman G. Bonney, M.D.

Denver

In view of the fact that nutrition is to a great extent the measure of nature's constructive efforts toward arrest, it is easy to appreciate the vast importance of diet. No matter how rigid the régime in other respects, nor to what degree the strength and energy of the invalid is conserved by judicious rest, nutrition remains largely dependent upon the ingestion of food sufficient to supply the natural demands and aid directly in the reparative process. The first great proposition, then, is that the patient should take an extraordinary amount of food daily, in fact all that it is possible to administer within the limits of digestion and assimilation. The word "administer" is used advisedly. It is not what the patient *desires* to satisfy the cravings of hunger, it is not what he is willing to take, or even what he feels personally he is able to eat, but it is rather all that the physician and nurse are able to persuade him to ingest through their personal influence and direction. The system of superalimentation is subject to great variation according to the individual, efforts appropriate for one case being entirely inapplicable to another. The tastes, desires and inclinations of the patient must be considered, the variety and character of food, the manner of cooking and the style in which it is served. Digestive disturbances must be recognized and obviated, not only by medicinal measures, but also by the quantity and nature of the food and the time of its administration.

Aside from these well recognized principles, the degree of success attained in the effort toward heroic feeding depends largely upon the personal influence of the nurse. The physician may emphasize ever so clearly the necessity of over-feeding, and the invalid in appreciation of this may recognize full well that a large measure of the responsibility rests directly upon himself, yet it may happen from various causes he is totally unable to take unaided a proper amount of food.

Depression of spirits, temporary excitement or fatigue with weakened will power may suffice despite his higher faculties to render the meal a failure. It is here that the usefulness of the trained nurse is very apparent. Through the various means at her command, according to her tactful judgment and the exigencies of the case, she is able to exercise an influence which in my experience very often turns failure into success. Her power may consist in quiet persuasion, exhortation or command, but the result is the same in either instance. My nurses are taught to employ all these measures when necessary, and that failure to enforce the ingestion of a satisfactory meal will not be overlooked save in the presence of fever, acute digestive disturbance, or other equally good and sufficient cause. A systematic endeavor is made to determine the limit of tolerance for each individual, who is subsequently compelled at any cost to consume the full quantity of food of which he is capable, not according to his own ideas, but as determined by judicious experiment and close clinical observation. It is astonishing to what a remarkable extent patients are able to ingest food, who at first protested their utter inability to take more than a modicum of nourishment. Persuasive appeals to such are usually of little value. Results are only obtained through authoritative command of the physician, supplemented by the ministrations of a nurse especially adapted to the work. I have in mind a young lady in far advanced phthisis, who protested strongly her repugnance and intolerance for food. Under no circumstances, she declared could she swallow a raw egg or submit to beef juice and cream. Through the firm directing influence of her nurse she has taken for many months, not only three large meals daily, but in addition fifteen raw eggs, eighteen ounces of beef juice and a pint and a half of cream, in addition to somatose and Russell's emulsion. Such a result would be impossible of attainment save for the personal influence of the nurse. The conclusion is logical, therefore, that the obligation of the physician to the patient is not met by the formal perfunctory statement that it is necessary to eat large quantities of food, nor still further by specifying the amount to be taken. His trust is not discharged until he places the patient in such an environment and surrounds him with such influences as will secure compliance with detailed instructions. The attainment of successful results depends not alone upon the advice received by the patient, nor entirely upon his ready acquiescence, but rather upon

the fortunate acquirement of such combined conditions as will insure the actual fulfillment of dietary directions.

It is hardly necessary to specify in detail the character of the food, which is necessarily subject to much variation in individual cases, the central thought in all being to have the patient consume as much as he can assimilate. It may be well to state briefly the considerations leading to selection of diet.

The policy of over-feeding embraces a careful consideration of the food eaten during the meal and the nourishment taken at other times. The fullest measure of success can be obtained only through a special effort toward the selection of such varied articles of food as will appeal to the appetite and cater to the tastes of patients who are notoriously whimsical. Generally speaking, pulmonary invalids are encouraged to partake of a mixed and unlimited diet with instructions to use butter and cream freely. No attempt is made to restrict the character or quantity of the food unless in accordance with special indications. In the absence of conditions clearly contra-indicative of heroic feeding, the patient is urged to ingest progressively increasing quantities, the urine, however being examined at short intervals in each case. Sweets, starches and fats, including pastry, are denied to patients with diarrhœal disturbance or with other evidences of gastro-intestinal indigestion. These are also interdicted for those with pronounced uric acid diathesis, the nitrogenous foods having been found productive of less harmful results than the carbohydrates. Digestive disturbances are treated not so much by diminishing the total daily quantity of food, but rather by its judicious selection and time of administration.

As far as extra nourishment is concerned it is desirable to introduce as much concentrated food as is practicable with the least resulting impairment of appetite and disturbance of digestion. My practice is to administer from two to four ounces of beef juice immediately upon awakening in the morning. This enables the patient to better undergo the bath and does not interfere with the appetite for breakfast which is served one hour later. The beef juice is repeated in the middle of the forenoon, afternoon and evening, and constitutes the only nourishment permitted between meals, as it is of small bulk and has not been found to impair the appetite for the ensuing luncheon or dinner. It has been my almost invariable experience that if considerable amounts of food in the shape of raw eggs and cream are taken between

meals the subsequent appetite is to a great extent destroyed. Thus it may result that the patient is able to take in the twenty-four hours actually less food than if there had been no attempt at extra nourishment. This unfortunate result rarely occurs if the eggs and cream are taken *immediately following* the meal. It must be made clear that such extra nourishment should not be taken as a substitute for even a portion of the regular food, but should be entirely supplementary to it.

After the invalid has eaten all that he feels he can possibly engorge, it is surprising how simple is the ingestion of raw eggs and cream, and with what beneficent results provided they are taken in the proper manner. The eggs should be uncooked and swallowed whole with a little sherry, lemon juice or ice water. In this manner they are introduced into the stomach without any special taste and do not become repugnant to the patient already satiated by a generous diet. Difficult as the feat of taking raw eggs may be considered at first by the invalid, it speedily becomes more or less of a joke, provided the eggs are fresh. Under no circumstances are the eggs to be beaten up or mixed with the cream or milk. If incorporated into a palatable beverage they eventually become distasteful and nauseating to the individual. If without special flavor and swallowed quickly they may be continued almost indefinitely. The average number of raw eggs consumed by my patients daily is one dozen, although many have taken from fifteen to twenty. Following the eggs a half a glass of cream is immediately taken. By some somatose in teaspoonful doses is given three times a day either in soup or the beef juice. Emulsions of easily digestible fats are often taken half an hour after each meal. In most desperate cases it is my practice to take advantage of every available opportunity for the administration of nutritive enemata consisting of beef juice, a beaten egg and peptonized milk.

Alcohol, although admittedly a food, is permitted but sparingly, and then only in the presence of clearly therapeutic indications. It is rarely given as a cardiac or general stimulant save in people of advanced age. Used indiscriminately it adds to arterial excitement, increases the tendency to hemorrhage, impairs appetite and promotes restlessness and insomnia. The detection of its odor upon the breath, or the flushing of the face, may be regarded as direct indications of its harmful effect even in the absence of stronger evidence. When taken in sufficient quantity to destroy the appetite and retard digestion, the amount of food supplied by the alcohol is far less than the nutritive value of the

food which would be ordinarily taken. To the diminished food supply occasioned by the alcohol in inordinate amounts is added the distinctly injurious effect of over-stimulation. Its intelligent administration, however, in small amounts and to carefully selected cases, may be attended with rare benefit. I sometimes permit a mild dry cocktail to be taken five or ten minutes before the mid-day or evening meal by those with fickle appetite. This should not be continued for any great length of time. If taken cold, only for such periods as advised by the physician, it may add to the consumption of food. A light ale, stout, or half and half taken with the meals is of some value as an appetizer and aid to nutrition. Taken during the evening it frequently is found to promote sleep. Occasionally a sherry, Rhine wine or Moselle may be taken with dinner. This constitutes the only manner of administration of alcohol which I am in the habit of permitting save in the presence of acute conditions demanding active stimulation.

CLIMATE AS A FACTOR IN THE TREATMENT OF TUBERCULOSIS

By Frederick I. Knight, M.D.

Boston

It being understood that there was a desire on the part of some of the members of this Association to discuss this question further, our chairman asked me to introduce the subject with a short paper. The report of the Committee on the Influence of Climate on Pulmonary Tuberculosis last year, though the committee was composed of residents of health resorts, was moderate in its claims, and to my mind a sensible and satisfactory report.

The history of the practice of medicine, which has always been mostly an art and but little a science, is a repeated history of the abandonment of old, tried and efficacious methods and remedies for new ones, which seem to promise better results or to be of easier application. Since the discovery that some cases of tuberculosis may be cured or arrested by out-door life in any climate, there has been evidence on the part of some practitioners of this same tendency, in disregarding or considering worthless any change in climatic conditions, a part of treatment formerly considered of much importance; they apparently claiming, to put it baldly, that it is only necessary to put the patient in the open air, no matter what the meteorological conditions may be, to ensure him his best possible chance for recovery.

What is Climate?

Scott[1] says: "Under the term climate we understand the combined effect of all phenomena (meteorological) whose distribution over the globe we have recently been considering, and which determine the suitability of various districts for the support of their respective fauna and flora." When we speak of the climate of a given region we mean the average weather conditions of that region. It is certainly unnec-

[1] Elementary Meteorology, London, 1885, page 338.

essary to state that average weather conditions vary immensely in different parts of the globe.

The question before us is whether these varieties of climate, or average weather conditions in different places, have any effect either on tubercular disease, or on the patient who is called upon to resist the disease to the extent of his ability.

The principal factors of climate are, as stated concisely by Dr. C. T. Williams,[2] latitude, altitude, the relative distribution of ocean currents, proximity of mountain ranges, the soil, the rainfall and the prevailing winds.

It is not necessary to our purpose to discuss these causative factors, but to pay attention solely to some of the more important resulting phenomena, especially temperature, amount of moisture in the air, atmospheric pressure, wind-force and sunlight.

There is no specific climate any more than there is a specific medicine for tuberculosis, but there is no ground for supposing that a tuberculous patient is exempt from the effects of weather conditions upon the individual in health, and if we admit that weather conditions have any effect, local or general, on the individual in health, then we must admit the possibility of utilizing this effect in treating morbid conditions of the body, tuberculosis included, and we must compare the possible effect of these elements as we find them at home, and as they may be found elsewhere, both upon the organs affected and upon the individual. For the sake of example we will suppose a patient to have incipient tuberculosis of the lungs and to reside in the northeastern part of this country, not far from the Atlantic coast. We will suppose that the patient has abundant means and that there is nothing to prevent his seeking other climatic conditions, if desirable. Shall he undergo the modern hygienic-dietetic treatment near home, or seek possibly better conditions? We are all familiar with the weather conditions in this region in the winter and spring seasons. Much cold moisture, many storms of snow or rain, and much cloud are distinguishing features as compared with the dryness and continued sunshine of some other region, *e. g.*, of the far West.

In the first place, may such conditions have any untoward effect on the disease locally? Is the patient more liable to have complicating inflammatory conditions, such as bronchial catarrh, lobular pneumonia, pleurisy, etc., and do inflammatory attacks favor extension of the

[2] Aero-Therapeutics, London, 1894.

tubercular invasion? It seems reasonable to answer all these questions in the affirmative.

In the second place, is the effect of one kind of weather (for climate is simply the average weather conditions of a place) just as good as that of another on the general condition of the patient? For it is the patient rather than the disease which is to be treated. Are the nutritive forces stimulated and built up just as well in a dark, damp climate as in a bright, dry one? Can one spend the same amount of time in the open air in these two climates? It seems reasonable to answer these questions in the negative.

If weather conditions make no difference, why do patients improve so much more at one season than at another? For instance, it is admitted, I believe, that patients gain much more in the Adirondacks in the cold, dry winter season than in the summer, which is comparatively warm and moist.

If it makes no difference what quantity and conditions of these elements are offered in any given place, why are all of us so anxious to have our patients get a residence on dry soil, with a sunny exposure, and protection from the strong winds? If sunlight is good at all, why isn't it better to have twenty-five or more days of it per month than to have ten or twelve, or less?

An aphorism of Cullen was that "the air of any place is better for a patient than that in which he grew ill." Change of climate changes the tune of the system, as it were, and change of tune is certainly good for the continued well-being of any instrument. Change to a high altitude is often followed at once by improved appetite and increased metabolism.

Is there one here who has not experienced the exhilaration, increased appetite and general improvement in going from the lowlands to higher resorts?

It is not contended that change of climate has any peculiar effect on the general condition of a tuberculous subject, but that it does effect metabolism in any one, and that there is every reason to avail ourselves of it in case of tuberculosis as well as in other morbid conditions of the body. If faulty nutrition is often the underlying cause of tuberculosis and what we are most anxious to improve, why neglect the consideration and regulation of one of the great forces which effect metabolism, viz., the atmospheric surrounding?

Huggard[1] claims that in regard to climate therapeutically the most fundamental point is its action on tissue change; and that its action on tissue change depends on its heat abstracting powers; that these depend not on temperature alone, but on temperature in combination with humidity and the amount of wind; and that the best climate for a person is that where nutrition is at its highest level, and nutrition is at its highest level where the demand for tissue change—the demand for the production of heat—best coincides with the patient's power of response. Hence a climate which is stimulating to one is depressing to another, and therefore the necessity for careful selection.

Though we may not be willing to accept this broad generalization, yet there seems no doubt that the abstraction of heat is an important factor in metabolism; and temperature, amount of moisture in the air and wind have certainly much to do with the abstraction of heat.

The first real hope in cases of pulmonary tuberculosis came to the practitioner in residence in supposedly better climates, on the Riviera and afterwards at mountain resorts in the Alps and our own Rocky Mountains; this while the patient in most respects pursued his ordinary mode of life.

It is certainly the experience of those in practice when sending patients to supposedly better climates was considered of first importance, that many patients recovered in those supposedly better climates without changing their mode of life at all, and many more would have recovered had they known about the importance of rest and other conditions now insisted on. It is true that some patients, having formerly tried climatic change, without proper judgment in selection and without proper medical oversight or modification of their daily life, without much benefit, have on returning home adopted under medical guidance proper hygiene and got well there. They have then disparaged climate, while, if they had followed proper rules of living away from home, they might have recovered even more quickly.

A factor which lately seems to be almost entirely neglected in the treatment of these cases is the personal comfort and pleasure of the patient and the effect of his mental condition on the disease. Too much stress cannot be laid on this. Home treatment in New England is certainly a harsh treatment, often involving a solitary life unless one is in a sanatorium. How different from the piazza life where one can be surrounded a part of the time at least by his family and friends;

[1] Handbook of Climatic Treatment, London, 1906.

or if the patient is able to take exercise, how much better to be where out-door life is pleasant practically every day!

Compare Dr. Solly's "invalids' day in Colorado Springs" in mid-winter with what we see our home patients endure! Thoroughly carried out, life in the open in the East in winter and spring is hard, very hard, but, if necessary, patients will usually submit to it for one season, in the hope of cure, but many refuse to undergo it a second season without much modification.

If one climate was just as good as another as far as the effect of its elements were concerned, for comfort and happiness, if for nothing else, a change from the East should be made when possible.

I will not go into a discussion of the question of high altitude treatment for suitable cases. The influence of the well-known changes in the blood and in the respiratory action, which result from life in a high altitude have not been fully determined; but the purity of the air and freedom from germs would alone seem to indicate its suitability.

In conclusion, my own experience both before and since the value of modern hygienic-dietetic treatment has been so generally recognized, has led me to continue in the belief that much is to be gained by the judicious selection of a patient's climatic or weather conditions, and that we do not do our patients justice unless we consider the possible advantage of change, when that is practicable.

THE RELATIVE VALUE OF HOME TREATMENT OF TUBERCULOSIS

By Lawrence F. Flick, M.D.

Philadelphia

Treatment of tuberculosis is of very recent birth. To do something to make a tuberculous subject get well; actually to contribute something towards his recovery by any other method than change of climate is a new concept, so new that very few physicians as yet grasp it. Such a treatment exists at present and is a valuable addendum to the armamentarium of the physician.

In the not very distant past there was but one course open to a tuberculous subject who wanted to save his life, namely, to change climate. This was called the climatic treatment, and whilst it did not save life very often, it did so sometimes when applied early in the disease. It was the only treatment in which the physicians and the people had confidence, and when it could not be applied the unfortunate victim was consigned to death on the slow-easy road of close confinement in a tightly shut up room with opiates, codliver oil, squills, tartar emetic and patent medicines of every possible description. Sometimes the poor fellow got well in spite of this and then the conclusion was reached that he did not have consumption.

Climatic treatment of tuberculosis in the sense here given has existed since the days of Hippocrates and during all this time held out hope but did not remove the stigma of incurability from the disease. The world believed that climate might cure tuberculosis but unanimously gave the verdict that the disease was incurable. The idea of the curability came with the new treatment of the disease.

Since the new treatment of tuberculosis has come into existence we speak of two kinds of treatment, climatic treatment and home treatment. With most physicians and with all of the laity climatic treatment still has the old meaning of going away to get well but with some physicians it has a new modified meaning, namely, of treatment

according to modern methods in a selected climate. In this new sense it seeks to take in all that climate can give as well as all that modern scientific methods can give. It is in this sense that I will consider it in comparison with home treatment and I do this in a spirit of fairness inasmuch as in the old sense it was not a treatment at all.

Home treatment of tuberculosis is treatment of the disease in the home country of the patient; in other words, in the climate in which the disease was contracted. It disregards climate altogether as a curative factor and tries to restore the patient to health with as little interference with home life as possible. It depends entirely upon science for its resources, that is, science in the broadest sense, exclusive of climate.

Both home treatment and climatic treatment may be subdivided into two kinds. Home treatment may be (*a*) in the home of the patient and (*b*) in a sanatorium; climatic treatment may be (*a*) in a hotel, boarding house or home of the patient and (*b*) in a sanatorium. Both treatments may be carried on in cities or country districts and both may be given on mountains or at sea level.

Home treatment and climatic treatment differ in the following items: Home treatment is entirely devoid of the element of climate; climatic treatment depends somewhat on climate. Home treatment is free from the worries and cares caused by absence from home; climatic treatment always contains the element of being away from friends and relatives. Home treatment is much less expensive than climatic treatment and does not break up business arrangements to the same degree as climatic treatment. In many cases it does not disconcert business arrangements at all. Home treatment then has everything that climatic treatment has except the climate, absence from home, heavy cost and interference with business; climatic treatment has everything that home treatment has plus the climate, absence from home, heavy cost and interference with business. In other words, climatic treatment has both a positive and a negative element which home treatment is devoid of, otherwise they are nearly alike.

Let us weigh some of these elements which climatic treatment has and home treatment has not. Climate of itself as a curative factor in tuberculosis has never been defined inasmuch as it eludes analysis. In the abstract it has been held of value, but all that it has been possible to say for it is that people have gone away and have gotten well. Modern investigation has proven conclusively that fifty per cent. of the

people who have an implantation of tuberculosis recover without being conscious of having the disease. Many who stay at home recover as well as many of those who go away. The go-a-ways usually are well to do people; the stay-at-homes are poor. A well to do go-a-way recovers and attracts attention; a poor stay-at-home recovers and is unnoticed, or if noticed is said not to have had consumption.

Spontaneous recoveries take place everywhere. We have no evidence that more take place in one climate than in another. In climatic resorts tuberculous subjects congregate, attract attention, and are under observation; when a recovery takes place it is noted, but when a case goes home to die or is sent home in a coffin no notice is taken of the matter. We have no statistics showing how many get well and how many die. In home climates things are reversed. Tuberculous subjects are scattered through the community and attract very little attention except when they die. Recoveries are never noted, but death always is. We have statistics of how many die but not of how many get well.

The only statistics bearing upon recovery from tuberculosis at our command at present are of a most general character and apply equally as well to the home as to climatic resorts. Autopsy records in different parts of the world show that, under the most conservative interpretation, fifty per cent. of all people who are born get an implantation of tuberculosis. As the percentage of people dying from tuberculosis varies from ten per cent. to twenty-five per cent. in different parts of the world, it is plain enough that the people represented by the difference between the percentage who get an implantation and the percentage who die must recover or at least die from some other disease. More than one-half of the people who get tuberculosis, therefore, recover, either spontaneously or through treatment. Unfortunately we have no statistics from health resorts showing what percentage of people who die have had an implantation of tuberculosis. Did we have even these we might be able to compare recoveries in health resorts with recoveries generally.

What does absence from home mean in the treatment of tuberculosis? Is it an asset or liability for recovery? Mental attitude undoubtedly plays a part in the treatment of tuberculosis. The best asset we have for recovery is good physiological metabolism. Just in proportion as a tuberculous subject becomes physiologically normal are his chances of recovery. He must eat well, digest well, oxidize well, elim-

inate well and sleep well. Whatever interferes with any of these functions inhibits recovery. Homesickness interferes with some if not all of these functions for a shorter or longer period, according to the individual, and homesickness occurs in most people who go away from home. Besides homesickness we are to reckon with fatigue of travel, life in a boarding house or hotel and the difficulties of acclimatization as interferences with normal physiological action. All of these are breaks upon smooth progress toward recovery, and one or the other may be the straw which determines the final outcome of the case.

Expense is an item which needs to be carefully weighed in the treatment of tuberculosis, as it may be the ultimate determining factor in recovery. Tuberculosis is a long drawn out disease even when the outcome is favorable, and whatever treatment is followed must be a long one. From the beginning, therefore, the cost of treatment should be kept in mind and so planned that it can be continued to a final issue. No difference how valuable a treatment may be temporarily, it is of no real value unless it accomplishes final recovery and a life of usefulness. Moreover, there must be something left for the patient to live on after he gets well. Recovery in tuberculosis is seldom so complete that the patient is free from tubercle bacilli absolutely and as a rule good health continues only so long as the mode of life is followed which has brought back health. A cured consumptive, therefore, has a decreased earning capacity after recovery and has to live at a higher cost of maintenance.

For the average individual the expense of climatic treatment is prohibitive and even for well to do people it is often embarrassing. The expense therefore is an impediment to recovery, and should be well weighed in calculating the value of climate as an asset in the treatment of the disease.

Interference with business is also a liability in the account of climatic treatment of tuberculosis which cannot be lost sight of. A man will give anything to save his life, and when told by his physician that he must sacrifice his business and go away he usually does so unhesitatingly and without regard for the future. This very step, however, often means his own ultimate ruin and the undoing of his family. It even may have a damaging influence on the immediate course of his disease through the worry which it excites and the fatigue which it involves. Pulling one's self up by the roots, so to speak, and transplanting one's self into a new soil is not an easy matter, and is necessarily accompanied by disappointments and heart aches of many kinds.

The financial loss involved in such a change often transforms a well to do family into an ill to do family, and leads not only to the death of the individual in whose behalf the change is made, but on account of the distress brought about to the physical undoing of other members of the family. Here again we have a well defined liability. The burden of this liability is very much increased by the traditional injunction of public opinion against the return of the "lunger" to his native land.

Having weighed those things in which climatic treatment differs from home treatment in tuberculosis, let us see to what extent the other elements in the treatment of tuberculosis can be better applied in the health resort than in the home of the patient. In order to be able to do this let us first carefully consider what the modern treatment of tuberculosis is. The treatment of tuberculosis as now followed by the most advanced workers in this field is a pretty exact science based upon principles well understood and correctly applied. These principles are: First, that tuberculosis being a parasitic disease, cure takes place (*a*) through development of resistive and destructive forces within the body and (*b*) through introduction of such forces from without the body into the body; second, that the curative forces developed within the body, all other things being equal, is better than the curative forces introduced from without the body; third, that all living things have inherent phagocytic power which may be increased or decreased; fourth, that phagocytic power in the living organisms runs parallel with physiological competency of the organism. In other words, the cure of tuberculosis depends upon natural resources of the individual reinforced by extraneous forces properly and timely applied; and our capacity to cure the disease depends upon our skillful regulation of life, so as to make available the natural resources and our timely application of artificial assistance.

Based upon the principles just laid down the modern treatment of tuberculosis consists: First, of a careful selection of diet; second, of regulation of exercise and rest; third, of regulation of mode of life; fourth, of medication; and fifth, of artificial immunization. In these five items we have a powerful armamentarium for the treatment of tuberculosis, and by their proper use we can cure every case of incipient tuberculosis and a very large percentage of even advanced cases. Every one of these items, however, is of importance and should be available for every patient if all is to be done for him which modern

science enables one to do. To be able to use all of these resources requires careful expert training which few men as yet have.

It is not within the province of the subject which has been assigned to me to go into the details of the treatment of tuberculosis or to express any opinion on the relative value of the various resources at our command. As I understand my subject, I am simply to compare the facilities for applying modern treatment of tuberculosis at home with the facilities for applying it in a health resort and to determine the relative value of the treatment under the two conditions. The question then is, can the modern treatment of tuberculosis be applied better in the home of the patient than in a health resort and in which are the conditions for the application of this treatment best and the ultimate outcome of the treatment most satisfactory?

I have already considered in a measure the relative influence of home life and health resort life upon the patient and have called attention to the drawbacks which absence from home places upon climatic treatment of tuberculosis. Let us now consider the relative opportunities which the home and the health resort give to the patient for expert treatment. In the past, when every health resort had a number of resident physicians who themselves had gone through an experience with tuberculosis and therefore had some knowledge of the disease, there were undoubtedly better opportunities in health resorts for getting expert treatment than in the homes of patients. This probably had something to do with the reputation which health resorts developed in the cure of tuberculosis. In those days there was no scientific treatment of tuberculosis and the man who had gone through a siege of the disease and had recovered was able to give better advice than the man who had not gone through such an experience. His knowledge was empyrical and the value of his advice depended largely upon his personal equation. Now, however, with definite knowledge about tuberculosis based upon scientific principles and worked out along scientific lines, knowledge of the treatment can be given to anyone who has the intelligence to receive it and is willing to acquire it, and men may be as well equipped to treat the disease in the home of the patient as in a health resort. Indeed in many ways the home physician, at least in large cities, may be better equipped because he has better opportunities for qualifying himself to make an early diagnosis, and successful treatment depends much upon early diagnosis. Physical diagnosis has been developed into a fine art, and it is within the power of most men with

fair natural abilities to become experts to such a degree as to enable them to diagnose the disease before there is any broken down tissue. To train an expert of this kind, however, is not an easy matter, and requires long service under a competent master with opportunities for careful comparison of physical signs with pathological findings. At present, therefore, the situation is somewhat reversed, and instead of finding the best trained experts for the treatment of tuberculosis in health resorts, with some notable exceptions, we find them in the large centers of population; and the opportunities for getting expert treatment are perhaps better in large cities than in some of the health resorts.

The next question is, can the modern treatment of tuberculosis be efficiently administered in a city or a country irrespective of climate? I unhesitatingly say it can, and I base this opinion upon a large experience under every conceivable condition. The results which have been obtained in the treatment of tuberculosis in sanatoria located irrespective of climate, in dispensaries, in city hospitals, and in the homes of the patients during the last few years leave no doubt upon this subject. Men from all parts of the world who have had experience in home treatment of tuberculosis are unanimous upon this subject.

We have been able to demonstrate moreover at the Phipps Institute during the last three years that the very best results can be obtained in the treatment of tuberculosis under most favorable conditions provided true scientific treatment is administered. A most striking illustration of the value of scientific treatment and complete control as compared with climatic influence has been brought out by the successful treatment of some cases at the Phipps Institute which had failed at the White Haven Sanatorium, although the two institutions are under the same medical director and the same medical staff. The only difference in the medical administration of the institutions is that the one is in the city, where the visiting physician has absolute control and where the most arbitrary discipline is in vogue, and the other is in the mountains, where the visiting physician goes at intervals of two weeks and where a greater latitude is given to the patients. Only advanced cases are admitted into the Phipps Institute and ostensibly those cases which are supposed to be in a dying condition, and yet recoveries take place there. The Institute is located in the slums of Philadelphia and is conducted in an old building which prior to its present use had been idle for four or five years. The wards, moreover, are crowded and have to be ventilated by fans.

In conclusion I wish merely to say that in comparing the home treatment with climatic treatment I have endeavored to be impartial and to express my convictions as based upon personal experience and general knowledge of the subject. I have no desire to prejudice health resorts nor to belittle what has been done by the men who reside in those places. If health resorts can produce better results than can be produced in the home of the patient I am quite certain that the facts will be brought out by the many competent men who reside in those places, and anything which I can say will merely stimulate activity in that direction and help to bring out the truth and in no sense work evil to the cause. What we all want is the truth and it is incumbent upon each of us to speak honestly from his point of view. In my judgment the treatment of tuberculosis can be better carried on at present in the home of the patient in those places at least where expert services can be given than in a health resort. For people living in places where expert services cannot be had, it is undoubtedly better to go to a health resort than to remain at home.

DISCUSSION ON PAPERS BY DR. KNIGHT AND DR. FLICK

Dr. S. A. Knopf, New York: It was my privilege to have read the abstracts of the two admirable papers to which we have just listened, and thus I have been in a measure familiar with them for some time, and have had a chance to think over what I might say in reply to them and how I could best utilize the short ten minutes which are granted me to open the discussion.

There is much that is good and true in both papers. I do not agree with everything that has been said, but that does not necessarily mean that these gentlemen are wrong. Therefore I have thought it best to state simply the maxims which have guided me in years of practice among the tuberculous, when I have been asked either by confrères who had called me in consultation, or by the patients directly, what climate to choose in order to hasten a cure.

1. To deny the beneficial influence of certain climatic regions as a valuable adjuvant in the treatment of tuberculosis, is as dangerous and unscientific as the belief in the specific curative quality of any particular climate.

2. A change of climate, though not necessarily a marked one, except in the very latter stages of the disease if of either a pulmonary or laryngeal character, is nearly always good. While a change from an

unfavorable climate to a favorable one, or from a good to a better, must naturally be considered preferable, this rule is by no means inflexible. When the patient has contracted tuberculosis in a favorable climate, a change to another even to a seemingly less favorable one, may accomplish as much good for this individual as the reverse in others.

3. The native locality of the tuberculous must be taken into consideration when making a climatic change. The patient who spent his early youth in Norway or other parts of northern Europe or one born in Massachusetts, Maine or northern New York, where the winters are rigorous, will usually do better in such climates as Colorado, the Adirondacks, Sullivan or Orange counties of New York offer. The sons and daughters of sunny Italy and our American born citizens from the warmer zones will do better in climates such as are to be found in southern California, New Mexico, Arizona, North and South Carolina, Virginia, Florida, Bermuda, etc.

4. To the foregoing rule there are exceptions, and besides consideration relating to nativity, one should be guided in a large measure by the patient's personal experience. For example: A cold climate may be selected if he has found by experience that he feels more comfortable and less distressed in winter. A change to a warmer climate is indicated when the reverse is the case. When the experience of the patient has demonstrated that he felt better near the sea-coast or vice versa, this factor must also serve as an indication for his domicile while seeking cure.

5. There exist idiosyncrasies in regard to climato- and aero-therapeutics as they exist in hydro-, electro- and medicinal therapeutics. These idiosyncrasies cannot be discovered beforehand, they can only be learned by experience.

6. High (above 3,000 feet), moderately high (1,500–3,000) and low altitudes, hot and cold regions, sea-coast and ocean climates, prolonged voyages and life on house-boats on rivers and lakes, extreme dryness and moisture; all these conditions have proven advantageous in a number of cases.

7. The value of any climate to a tuberculous patient cannot be determined or compared with any other unless the patient lives under careful medical guidance in a sanatorium or private home, and follows the best hygienic and dietetic treatment.

8. Laryngeal cases, in the earlier stages with relatively little pulmonary involvement, are often benefited by a change to a moderately

high or to a warm moist climate between 500–1,500 feet altitude. In pulmonary cases a weak heart, distinctive heart lesions, emphysema, constant fever and extreme nervousness are contraindications to high altitudes. Wherever such pathological conditions as were just mentioned do not exist, high altitudes and cold or cool or hot and dry regions dust free, or at least relatively dust free, will always prove a valuable adjuvant in the treatment of tuberculosis. Early pulmonary hemorrhage per se need not be considered in determining a choice of climate. However, as a rule, and particularly in cases inclined to frequent hæmoptyses, long distant journeys should be made with frequent rests and high altitudes approached only gradually. Not a few cases with slight bronchial symptoms (bronchitis), but weak hearts and evidences of mixed infection do well at the sea-coast for the greater part of the year. Prolonged ocean voyages may also prove beneficial in such cases. The patient, however, must not be subject to seasickness, must be fond of the ocean and be in a situation to travel in comfort and with ease on a steamer or large ship, with a medical officer on board.

9. The ideal climate for the average pulmonary patient, in the earlier and more hopeful stages of the disease, is the one where the extremes of temperature are not great, with the purest atmosphere, relatively little humidity, much sunshine, and all conditions which permit the patient to live comfortably out of doors the largest number of days out of the year and the largest number of hours out of the twenty-four.

For tuberculosis of the bones and joints and scrofulous affection of childhood the sea-coast climates in our temperate zones come nearer to deserving the term "specific" than anything else. The peculiarly beneficial influence of sea-coast climate in bone and joint tuberculosis is doubtlessly to be ascribed to the aseptic and ozonic quality of the air and the iodides and other salts suspended therein. But pure air and out-door life in whatever locality can and should be utilized in the treatment of tuberculosis and scrofulous affections of childhood.

10. In the choice of locality for the purpose of a climatic change for any patient, besides the pathological considerations enumerated in paragraph 8, many factors must be taken into account. These are:

A. If the patient wishes to return to its present home, after improvement or restoration to health, or not? Experience has shown that when great climatic changes have been made patients frequently relapsed when returned to their former home.

B. If the patient is married or single, young or old, willing or unwilling to leave. If the patient is subject to nostalgia, and generally much attached to home environments, sending him far away, and particularly if against his wish may often produce disastrous results, for mental depression retards recovery, and aggravates pathological conditions.

C. If the patient is sanguine and cheerful he will usually do well even at a long distance from home, in isolated regions, within or outside of a sanatorium.

D. For the morose and hypochondriac patient, isolation or long distances away from home have often produced the same result as nostalgia.

E. To remove an advanced and evidently hopeless case from his home to a long distance is as cruel as it is unscientific unless it is done by the patient's special request and with the likelihood of obtaining the object in view to lessen his sufferings and make him happier in general. Slight climatic changes with short distances to travel are often beneficial in such far advanced cases when made with the absolute consent of the patient.

F. The patient's financial condition must be such that by his removal to distant localities, and his subjecting himself to the hygienic and dietetic treatment in special institutions or health resorts, he will not become destitute and a burden to the community which has extended its hospitality to him. His means should be sufficient to avoid all possible anxieties and worry in this respect.

11. When the situation is such that the choice of the home climate or home treatment must be taken into consideration, we should bear in mind the following: The patient will do better in the outskirts of the city than in the city, better in the higher parts of the locality than in the lower; better in a clear or relatively clear, dustless atmosphere than in a dusty one; better in a pure smokeless or relatively pure and smokeless locality than in one full of smoke and odors; better in a locality where he may get the benefit of whatever sunshine there is than in a valley, cañon or narrow street surrounded by high buildings; better where there are few houses than many; better where there are relatively few people than where there is overcrowding; better where there is little traffic and little noise than the reverse.

12. Lastly, we must consider that the majority of consumptives are recruited from the laboring classes, and those we must cure in the same

or nearly the same climate in which they will have to live and labor after their restoration to health. While the cure of the consumptive individual in his home climate, which is in most instances far from the ideal, may often necessitate a longer space of time, at the end there is an advantage from this. Experience has demonstrated that relapses among this class of cases are fewer and the cures thus more assured and lasting than those obtained in more congenial climes. Our hope for the eradication of tuberculosis in the present state of our social fabric lies in prevention by education, better housing of the laboring classes, abolition of child labor, the treatment of tuberculosis in children in sea-coast and inland sanatoria, the improvement of the social condition of the masses in general, utilization of selected climates for the well-to-do adult cases, and the application of the hygienic and dietetic treatment to all, and to the majority the sanatorium treatment at home or in special institutions in our home climates.

Dr. S. G. Bonney, Denver: It seems to me to be very appropriate that the three gentlemen who have read papers upon climate have been residents of localities not regarded as favorable to tubercular patients. It hardly seems fitting for residents of health resorts to exploit individual climates, or perhaps even climates in general. Anything I could say would, in the first place, infringe upon the time which has been so admirably taken up. My views have been exceedingly well expressed by Dr. Knight and Dr. Knopf; therefore I shall not enter into a discussion of the relative value of home treatment and climate for tuberculosis. I should like, however, to pay a tribute to Dr. Flick for the very moderate tone of his paper and his evident sincerity and honesty of conviction in what he has stated. I wish most heartily to congratulate him, also, upon the results he has obtained though greatly handicapped by climatic conditions.

I wish to take emphatic exception to Dr. Knopf's statement regarding the sending of patients with advanced tuberculosis away from home, which he regards "both as cruel and unscientific." I believe that it is impossible to say that any given case of tuberculosis is utterly and irretrievably hopeless. I have endeavored to make clear in another paper read before the Association that death sentence cannot be pronounced with absolute certainty upon any case, and the consumptive, no matter how far advanced, provided other conditions do not preclude such a step, should be accorded every possible opportunity to secure an arrest of his infection.

Dr. C. F. McGahan, Aiken, S. C.: Dr. Flick has laid some stress upon homesickness. I have been in health resorts all my professional life and it is rather rare to meet with more homesickness in these resorts than is ordinarily met with in other places. Sometimes one or two patients will become homesick, but, in the majority of the cases, the freedom from the cares of home life does much good. Of course there are some exceptions. I have in mind the case of a young man who was engaged to a young lady and he was doing finely. The young lady visited him and that day he had temperature and lost ground, and it was a long time before he regained what he had lost. A second visit was made and he again ran down. I objected to these visits of the young lady and I asked that they cease. When she ceased coming he rapidly improved. This is only one of the many instances. I find that, as a rule, men that go away from home improve faster because they have no home worries. Dr. Flick has mentioned a number of such cases.

At the health resorts we get a large percentage of the bad cases. We tell the doctors not to send them to us; if the patients are bad, keep them at home. But they keep the early cases at home until they become bad and then they send them to us. That is the reason why the large percentage of the cases at the health resorts do not recover; they are not the early cases.

Dr. Flick in his paper said that 100 per cent. of the incipient cases should get well; I think he should go even further and say the pretuberculous cases. If we get 60 per cent. cures of the incipient cases I think we are doing great work. Most men would feel perfectly satisfied if they got 60 per cent. of incipient cures.

We have to consider climate and each individual separately. There are three distinct climates, viz.: (1) That with a high altitude where the sun shines all day long; (2) that climate in which a certain amount of dryness exists, but no altitude to speak of; (3) temperate climate, as in the Bermudas, etc.

We all insist upon one thing, and that is fresh air and plenty of it; not a small amount, but the more the better. Last March we had thirty clear days, the thirty-first being partly cloudy. That enabled the tuberculous patients to be out of doors all day for thirty days of that month, a thing impossible to do in the northern climates at that time of the year.

With regard to the definition of climate, I think climate is what you can get miles away, or anywhere; it is simply a change.

Any patient who goes to any health resort should be under medical advice. I believe they fare worse at these health resorts without it than they do at home; as at home they have the restraint of the family, and they are told not to do this and not to do that. I consider that to turn a patient loose is wrong; he should have certain restraints and medical guidance, not only being told how much to eat, but how far to walk. I read a paper a few years ago in which I related the instance of a man who was told to walk until he was tired; I found that he walked twenty miles a day. He was an athlete. In 1899 I read a paper before the American Climatological Association in which I advocated a law to be passed by the board of health that wherever there was a room occupied by a tuberculous patient that room should be fumigated and a certificate given to that effect. I got that law passed in Aiken and now it is a universal one. We resort men have been pioneers in this work.

Dr. Thomas D. Coleman, Augusta, Ga.: Owing to the lateness of the hour and the heat, I shall endeavor to condense my discussion of this paper. There are two distinct types of cases to be considered in this discussion. First, the pauper patients, many of whom live a dissipated existence, are thriftless, and often are in the worst possible condition physically and morally. Manifestly if you take these people from their surroundings, feed them properly and make them live regular lives they are going to gain, and many of them get well even in an unfriendly climate. Dr. Flick is doing a good work in demonstrating that these patients can be cared for at home. It is their only salvation, for it is plainly impracticable to send these patients to more favorable climates, for even if the means of transportation could be furnished them, their mere existence in favorable climates would be precarious for reasons too obvious to mention. Secondly, we have those better situated in life who are able to travel and pay for such comforts as may be obtainable in climates where they may lead an outdoor existence most of the time. To these the change of regime suggested by Dr. Flick is not so great a reversal of the mode of living, as in the case of the very poor, for these patients are amply able to obtain in their homes all that Dr. Flick suggests in the way of feeding and medical supervision. To these a favorable climate offers the one important item in their treatment which they cannot obtain at home. As to getting 100 per cent. of cures in incipient cases, that is beyond my wildest dreams. I have always considered tuberculosis to be like other infections, and

believe that its ravages depend upon the amount and virulence of the infection, and the resistance of the infected. After all, it seems to me that the matter can be boiled down to an "argumentum ad hominum." If you yourself had tuberculosis and possessed the means to go to a climate less rigorous than your own, less subject to sudden changes, you would not chose a densely populated city like Philadelphia, Chicago, New York, etc. It seems to me that we should avoid getting into the attitude of mind of the old lady who, after watching the parade of the militia, remarked with great pride to a listening friend that "every man in line was out of step except her son Bill."

Dr. Thomas Darlington, New York: It is not every patient who should go to high mountain resorts. It is not every patient who should remain in the city. Yet there is probably more in climate than many people realize. The New York Board of Health has given this first consideration in dealing with the poor class of patients. But if you can get fresh air and rest without climate you can get wonderful results. But this does not mean that you should not always add climate. Take the experiences of those in Switzerland, or in the Rockies, and it has been shown that the blood cells positively do increase in number at these elevations. The place where you can get more and better sunshiny days, away from the noisy city, away from the East winds, etc., is what you want and it does make a difference. Undoubtedly you can get wonderful results in the poorer class of patients though, those who have had insufficient amount of food, placing them almost anywhere; they will improve and grow quite stout. These certainly show wonderful results. Many of them get well and return to work. Now this does not mean that climate does not have much to do with it. You cannot ignore climate.

Dr. F. I. Knight, Boston: I wish it to be clearly understood, so far as my own practice is concerned, that, in the large majority of the cases which come to me for treatment, either in the sanatorium or at home, I never think of making a suggestion of change of climate, never making it unless I know the patient is able to afford it. It would be like recommending dispensary patients to have woodcock and champagne. But if they are able to make the change I give them an opportunity to do so.

With regard to the mental depression, it has been my experience that patients who submit to the proper treatment at home are more likely to be depressed than those away from home, especially if they have ahead of them a second winter of outdoor treatment in New England.

In regard to return home after treatment at health resorts, I think an erroneous idea prevails to some extent.

There is no reason in the manner of a patient's cure why he may not live afterwards in his home climate, and many have done it successfully, but there are some who can continue to live in comfort away from home, but fail when they try to live at home. There is no more reason for refusing to give a patient the benefit of change because he must sometime return home than to refuse champagne in an emergency because the patient cannot continue to drink champagne all his life.

With regard to sending away from home the advanced cases, we all agree on that point. As a rule, they should remain at home, but I have sent away patients who I knew, and they themselves knew, would not live to get back. I remember especially the gratitude of one patient who was advised to go away and die in comfort in a proper climate.

Dr. S. A. Knopf, New York: Dr. Bonney is mistaken. I did not say it was cruel and unscientific to send an apparently hopeless case to far distant health resorts, for that might be unwise in some instances, for he just told us that he had recently cured no less than ten seemingly hopeless cases. In my maxims in paragraph 10, *E.*, criticized by Dr. Bonney, I speak of advanced and evidently hopeless cases. There is a vast difference between an apparently and an evidently hopeless case of pulmonary tuberculosis. I also desire to correct my good friend, Dr. Bonney, when he thinks that because I am living in New York I am without any experience as a resident in climatic resorts in the far West, California, etc. I wish to say that I received my early medical training in the College of Medicine of the University of Southern California, that I spent a year in the Los Angeles County Hospital and that I began the practice of medicine in the very city of the Angels.

It was in the Los Angeles County Hospital, while a young interne, that I saw our wards constantly overcrowded with dying consumptives, who had come to California in the last stages with little or no money, firmly believing that the glorious climate of California would suffice to make them well within a few weeks. It was there that I realized that the solution of the tuberculosis problem lay in the successful treatment of the majority of consumptives in or near their home, wherever that may be. My interest in the study of the hygienic and dietetic treatment independent of climate began then and there. I have kept up my interest in this subject and have ever since turned my

efforts in the direction of the establishment of sanatoria for the poor near all the large centers of population, and have written and lectured on the sanatorium treatment at home. Just as then, so do I believe to-day that we must treat the majority of consumptives in or near their homes, and in the same or nearly the same climate in which they will have to live and labor after their earning capacity has been reëstablished.

A SUGGESTION IN THE TREATMENT OF HÆMOPTYSIS

By Lawrason Brown, M.D.

Saranac Lake, N. Y.

The cause and treatment of pulmonary hemorrhage have interested physicians since the time "when the memory of man runneth not to the contrary." Its importance in pulmonary tuberculosis has long been known though it is more recently that its true relation to the disease has been established. Long a mooted point in medicine, hæmoptysis has been held by many famous authorities, among them Hippocrates, Galen, Aræteus, Hoffman, Boerhaave, Van Swieten, Graves and Niemeyer, as a precursor and even the cause of pulmonary tuberculosis. Opposed to them stood Richard Morton, Portal, Bayle, Laennec and Louis. Walshe, in the middle of the last century, showed clearly that Laennec and Louis were correct in holding that in most instances symptoms preceded the hæmoptysis which should, therefore, be looked upon rather as the result than as the cause of the pulmonary tuberculosis. A few years later, 1868, Rasmussen of Copenhagen published in the *Edinburgh Medical Journal* his pathological researches upon the origin of hæmoptysis. He showed, as you will recall, that fatal hæmoptysis proceeds from a ruptured aneurysm in a pulmonary vessel. Since then it has been clearly established that fatal hæmoptysis is due in practically all cases to the rupture of an aneurysm situated upon a branch of the pulmonary artery. Few, I might say almost no, well-authenticated cases of fatal hæmoptysis have occurred from rupture of the pulmonary vein or of the bronchial artery. It has long been known that the walls of the pulmonary vessels are quickly attacked in tuberculosis. The endarteritis itself is usually obliterating. Even when this does not occur the vessel walls are thickened and immobile.

The pulmonary blood pressure may be affected by change in the calibre of the blood vessels, in the greater or lesser circulation, by increased or lessened flow of blood, by change in the rate of circula-

tion and by failure of the left side of the heart to perform properly its function. Recent work has thrown much doubt upon the existence of vaso-motor nerves in the pulmonary vessels and it is probable that, caeteris paribus, the pulmonary pressure is directly determined by the amount of blood supplied to the right ventricle.

Hæmoptysis may be controlled theoretically by increasing the coagulability of the blood, by lessening the rapidity of its flow, by reducing the volume of blood in the weakened vessel, by lowering the blood pressure or by constricting the affected vessel, which may act in one of the ways heretofore mentioned. Calcium chloride or lactate has not accomplished in my hands what I was led to hope for from Wright's experiments. Digitalis has often signally failed to be of any benefit. The pathological changes occurring in the pulmonary vessels in the diseased area preclude any changes in their calibre. All drugs, therefore, which cause a contraction of the blood vessels, *e. g.*, ergot, etc., would, if they acted upon the pulmonary vessels, be directly injurious, as they would cause a contraction of the healthy vessels, and the diseased vessels, incapable of varying in diameter, would be subjected to increased instead of lessened tension. Recent experimental work which has been mentioned, would seem to indicate that lessened tension from dilatation of the other pulmonary vessels does not take place.

For these reasons we must seek elsewhere to regulate the pulmonary tension and in considering the subject the first thought is to lower the tension by reducing the volume of blood in the circulation. All severe hæmoptyses act quickly in this way and in most instances render venesection useless and even dangerous. Another attempt in the same direction is ligation of the limbs, a modern modification of Junod's boot.

More recently, however, a group of substances has been brought into use which exert a very marked effect upon the blood pressure. I refer to the nitrites. Their action, as you will recall, consists chiefly in producing a dilatation of the peripheral vessels mainly of the head and neck and of the vessels of the splanchnic area, causing a marked fall in the blood pressure while the heart is accelerated. The different members of this group vary in regard to the rapidity, the intensity and the duration of their action. The accompanying diagram, borrowed from Bradbury by Cushney, will illustrate the individual peculiarities of the nitrites. Amyl nitrite acts instantaneously but only for about five minutes. Nitroglycerin, and in fact all the other nitrites, act less

vigorously but much longer. Nitroglycerin acts more quickly and more intensely but for a slightly shorter period than sodium nitrite. In both the action is well marked in fifteen minutes and lasts for one to two hours. Erythrol tetranitrate acts much more slowly and attains the height of its action in about two hours but its duration is much longer.

Theoretically amyl nitrite should be administered at once in the case of hæmoptysis and repeated if necessary in five minutes. Following the first dose, nitroglycerine or sodium nitrite should be given and in a few minutes (twenty to thirty) erythrol tetranitrate should be given. This would insure a lowered pulmonary tension for some time. The great difficulty, however, lies in the fact that it is difficult to tell just when to repeat the dose. It is dangerous to lower the blood pressure too much and dangerous not to lower it enough. To overcome these difficulties I have recently taken the patient's blood pressure every two hours and ordered the doses accordingly, aiming to keep the tension in certain limits. Practically I use amyl nitrite as suggested and if the patient is nervous administer morphine (gr. 1/8) hypodermically and along with it nitroglycerin, or, which I prefer on account of its greater stability and fewer untoward symptoms, sodium nitrite (gr. i). In some cases the patient cannot inhale amyl nitrite and in these cases the sodium nitrite or nitroglycerin should be given hypodermically immediately and repeated as often as necessary. A careful nurse may be quickly trained to take accurate readings of the sphygmomanometer and the cuff may be left upon the arm indefinitely if preferred. To determine at which level to keep the blood pressure I take it several times at short intervals and attempt to keep it usually between "100 and 115 or 120 mm. of Hg." It is comparatively easy to do this with the aid of sodium nitrite.

Hæmoptysis frequently recurs or even occurs in the early morning hours and the patient awakens spitting blood. Howell's theory of sleep offers a striking explanation of this phenomenon. This observer holds that sleep is due to the fatigue of the vaso-constrictor center (or centers) and he has shown by the plethysmograph that a dilatation of the peripheral vessels occurs during sleep. In the early morning hours, when the vaso-constrictor center is regaining its lost tone, remarkable vacillations occur in the plethysmographic records, which would indicate considerable variation in the quantity of blood supplied to the right side of the heart and, as we have mentioned before, con-

comitant variations in the pulmonary blood pressure. Sudden variations in pressure are, in all probability, more dangerous than a steady high pressure. To prevent these variations as much as possible and to equalize the blood pressure, I have recently given morphine and sodium nitrite hypodermically between midnight and two a. m., waking the patient if necessary.

Aconite has been suggested in the treatment of hæmoptysis and its use, when controlled in the foregoing manner, may prove to be very beneficial. I would suggest its use in cases complicated with fever.

To recapitulate briefly, I would suggest that the blood pressure be frequently observed, that morphine be used when necessary to quiet the patient and so equalize the blood pressure, that sodium nitrite be exhibited to reduce when necesary the blood pressure, and that in case of a sudden hæmoptysis amyl nitrite be administered at once when possible, to produce a marked fall in the blood pressure and so aid in a temporary cessation, at least, of the hæmoptysis.

In no symptom, or complication, as you wish it, is judgment of the effect of any treatment more difficult than in hæmoptysis. I am fully persuaded that many of our patients recover from hæmoptysis in spite of our treatment. I have had too few cases to hazard anything more than a tentative opinion upon the beneficial effects of this method of treatment. It seems to me, however, a little less empirical than many others and I submit it to you in the hope that any of you who think well enough of it will endeavor to establish its value or to prove its worthlessness.

MANIFESTATIONS OF SYPHILIS ASSOCIATED WITH PULMONARY TUBERCULOSIS

By John H. Pryor, M.D.

Buffalo

While some text-books devote attention to the methods employed in distinguishing between the lesions of syphilis and tuberculosis, the recognition of the coexistence of the two affections has not received the consideration which it seems to deserve.

During the last two years I have observed fifteen cases of syphilitic disease associated with pulmonary tuberculosis. The diagnosis of tuberculosis was verified by the finding of bacilli in all the cases cited. In every instance a complete history of syphilis was obtained. All the patients had the initial lesion marked secondary manifestations, and had undergone treatment. At the time of observation the interval which had elapsed since the appearance of secondary symptoms varied from one to fifteen years.

The cases are divided into two groups for clinical purposes. Eight exhibited syphilitic lesions and seven showed symptomatic manifestations which promptly responded to the therapeutic test. The distinct, specific lesions found in seven patients were infiltration and ulceration of the larynx, pharynx, soft palate, nasal cavity and tongue. Without exception these lesions had been regarded as tuberculous and the treatment was based upon that belief. In one instance a gumma of the neck had been followed by deep ulceration, which had existed for three weeks. It had been pronounced a carbuncle and later ascribed to tuberculosis. In this series of cases proper local and constitutional treatment was followed by prompt relief and recovery. The mistake in diagnosis was apparently due to the fact that tuberculosis was held accountable because that disease was known to be present. Of the patients suffering from symptomatic manifestations, one complained of persistent frontal headache and myalgia, involving the muscles of the shoulders. One insisted that he had attacks of aphasia, vertigo and

numbness of a portion of the left arm. One suffered from neuralgia of the legs, particularly at night; sometimes the pain was confined to the heels alone; and four under the most favorable conditions showed no gain, or only slight increase in weight; anæmia, languor, fitful appetite and a daily rise of temperature to 100° or 101° for weeks.

Suspicion of the latter group was aroused, because they were all incipient and favorable cases of tuberculosis. Complete rest, open-air treatment and increased alimentation for a period varying from three to six weeks was not accompanied by improvement, or the symptoms grew more pronounced. When closely questioned the history of syphilis was elicited and anti-syphilitic treatment was followed by remarkable improvement.

Allow me at this time to anticipate the natural comment that any of these symptoms, and especially the diurnal rise in temperature, could have been caused by tuberculosis or mixed infection. Of the fifteen cases presented as suffering from the double infection of syphilis and tuberculosis twelve were regarded as incipient and favorable and three were moderately advanced.

We do not expect patients with a slight tuberculous lesion and little evidence of constitutional derangement to maintain a daily rise of temperature to 100° or 102° for weeks under modern methods of control. It is admitted that this may occur, but the fact that such behavior is unusual should incite a search for another cause, and syphilis should be suspected, particularly if gastro-intestinal disturbance is absent.

Twelve of the fifteen cases were characterized by an evening elevation of temperature above 100°, and in three cases the temperature showed a persistent rise over that of the preceding day. I regard this manifestation in the class of patients under consideration as one of important diagnostic value. The effects of treatment upon the fever was most marked. In two instances the temperature dropped to normal in four days, in the remainder it fell to normal, or 99°, in eight days.

At the present time we are still compelled to accept the therapeutic test as evidence in the detection of syphilis and its multiform phases. It is doubtful if the dual infection or association of the two diseases renders a prognosis as unfavorable as the literature might lead one to presume. Eight of the patients apparently recovered from tuberculosis, and in seven the disease was arrested. Of course sufficient time has not elapsed to pass judgment upon the ultimate result.

The difficulties in the administration of the iodides to the syphilitic

and tuberculous patient have been exaggerated. This is particularly true of persons afflicted with incipient tuberculosis. Iodide of potassium was given in solution or with the essence of pepsin, in doses ranging from five grains to fifty grains, three times daily, and was not folsyphilis exists alone. Careful attention was paid to the behavior of the lowed by any more disturbance than that usually encountered when tuberculous focus in the lung with reference to the influence of iodide of potassium upon the diseased process. In one instance the moist rales and the amount of expectoration were increased, but in all others no change of this character was detected.

Mention should be made of one case characterized by the interesting clinical phenomena which have sometimes proved puzzling.

B. F., age 45, had secondary manifestations twelve years ago; no symptoms since. Four months before coming under observation was treated for pleurisy at base of left lung. Three months ago he began to lose weight, developed some evening temperature and a cough with expectoration. One month ago bacilli were found, and a diagnosis made of pulmonary tuberculosis.

Upon examination I found evidence of a lesion at the left apex and also one at the base of the left lung. Both were active and the one at the base seemed to be undergoing softening. Bronchial breathing and an abundance of fine, moist rales were present. After three weeks had elapsed I noted that his general condition was improved, but the temperature gradually rose in spite of absolute rest. Suddenly he developed nervous symptoms, which seemed distinctly syphilitic in origin. A full history of syphilitic infection was admitted. During my absence for a period of two weeks his symptoms became more pronounced and he was given thirty-five grains of iodide of potassium three times a day with daily inunctions of mercury. After three weeks of this treatment I found that all pathological physical signs had disappeared from the base of the lung, with the exception of slight relative dulness, and the improvement in the signs at the apex was quite remarkable. The great change in the physical condition and signs and the decline of the temperature to normal, led an able clinician, who had observed the patient during my absence, to the conclusion that the thoracic disease was entirely due to syphilis, and the diagnosis of associated tuberculosis an error. Three weeks later I examined the patient again and found no evidence of disease at the base, but the signs of a quiescent or arrested lesion at the apex. The temperature continued

normal. It seems fair to assume that he was suffering from a dual infection of the lung, and it seems probable that the disease at the base of the left lung was syphilitic and that at the apex tuberculous.

Some years ago I observed two advanced cases in hospital practice of the type earlier described as syphilitic phthisis. They were cases of tuberculosis with syphilitic taint, and possibly a closer study will sometimes explain the role played by obscure manifestations of syphilitic poison in changing the clinical picture exhibited as due to hopeless tuberculosis.

The purpose of this brief and general presentation of a few cases is to attract attention to the following conclusions:

Pulmonary tuberculosis is often held responsible for too many manifestations of disease which are due to other causes.

The fact that a patient has tuberculosis should not be an excuse for disregarding these conditions, which often have a decided influence upon the prognosis and cause much avoidable discomfort.

Syphilis is a common disease, and physical debility combined with worry and mental distress, which may accompany tuberculosis, may arouse a latent syphilitic taint.

The association of the two morbid conditions may be disguised and the symptoms confused.

Furthermore, many of the manifestations of syphilis are quite similar to those produced by tuberculosis.

The diagnosis of syphilis, in connection with tuberculosis, will require close scrutiny and often the therapeutic test.

Persistent fever above 99½° in incipient cases of tuberculosis, when the lesion is slight and the general condition not much impaired, and when rest with proper treatment for a period of three or more weeks fails to secure an amelioration, should be viewed with suspicion and the possibility of associated syphilis thoughtfully considered.

This is also true when atypical pneumonia or intractable subacute bronchitis supervenes.

It is questionable at least if the prognosis in tuberculosis of the lung of an incipient type is rendered much more unfavorable when syphilis, particularly of the tertiary form, is also actively present.

The improvement in the tuberculous case following anti-syphilitic treatment is most marked and at times surprising. This is particularly noticeable in reference to the prompt and decided drop in temperature.

Unless my experience has been very unusual, syphilis is more often

associated with pulmonary tuberculosis than the paucity of the literature upon the subject would indicate.

The occurrence of the two diseases must be more common in hospital, dispensary and sanatorium practice than is assumed by most authorities.

In this paper no allusion is made to the differentiation between the two affections. The simple intent is to emphasize the importance of recognizing their coexistence and the efficacy of proper treatment.

DISCUSSION ON DR. PRYOR'S PAPER

Dr. F. I. Knight, Boston: The association of syphilis with tuberculosis is an interesting one. I thought that Dr. Pryor might be going to refer to the possibility of one affection retarding the progress of the other. He may remember the cases published years ago by a practitioner in Constantinople, who had had considerable experience in the combined affections, who was strongly convinced that syphilis engrafted on tuberculosis had a favorable influence on the course of the latter. I have never seen many cases of this combination, but I recall one case which pursued a long course attended with fibrosis of the lung, which might well have been favored by the syphilis.

With regard to the differential diagnosis between syphilis and tuberculosis, particularly of the upper air passages, including the larynx, it is, as a rule, quite easy; the manifestations of syphilis are so different. I remember one case, however, of a medical man who had a perichondritis of the larynx, which both Dr. Cohen and myself considered to be a typical case of tuberculosis. Dr. Cohen had photographs taken, believing it to be a typical illustration of tuberculosis. After a few months the patient had some other syphilitic manifestations which with the perichondritis of the larynx were cleared up in a few weeks by the administration of iodide of potassium. The patient never knew the source of infection, never having been aware of the initial lesion.

Dr. Henry B. Dunham, Rutland, Mass.: At the sanatorium at Rutland, Mass., we have had quite a number of cases in which the two diseases, tuberculosis and syphilis, have existed. A fairly large number of men who have applied for admission have given a previous history of syphilis. The disease in these cases had been treated and the manifestations cleared up before the onset of the symptoms referable to tuberculosis. There are so many of these cases that I do not see how there can be so marked an antagonism betweeen the two diseases as was at one time

thought to exist (and as mentioned by Dr. Knight) unless it is that the tuberculosis resulted from an over-treatment of the syphilis. I have sometimes thought that the specific treatment when pushed too far might be a factor in the creation of more favorable soil for the production of tuberculosis. I should like to ask Dr. Pryor if anything had been done in his cases when syphilis was suspected in regard to a search for the spirochætæ pallida. I have recently treated one case with a large ulcer on the tip of the tongue, which was undoubtedly syphilitic, tuberculosis of the lungs and larynx being present. The ulceration improved and practically cleared up under the administration of the iodides. Neither tubercle bacilli nor spirochætæ, however, were found in the scrapings from the tongue. At the outside houses in Rutland, Dr. Butler has treated a number of cases where there was an association of syphilis and tuberculosis and occasionally of syphilis, which at first was thought to be tuberculosis. I wish Dr. Butler were here to tell about these cases. At the sanatorium it was principally the laryngeal cases that on failing to respond to the ordinary treatment have been given the iodides and mercury and proved their syphilitic nature by their subsequent rapid improvement. I hope that the microscope, as soon as we have improved technique for discovering spirochætæ, will make it less necessary to fall back on a diagnosis by drugs, as I think that large doses of mercury or iodides are almost invariably exceedingly injurious in cases which prove to be simply tuberculosis. At the sanatorium from the point of view of economy in administration it is unwise to take syphilitic patients because they must be kept separated from the others. As a result of this, most of the cases in which the two diseases were known to be associated have not been accepted. With the majority of such patients the tubercular disease was rather far advanced and they would not have been considered suitable for treatment even though they had no syphilis.

Dr. John H. Pryor, Buffalo: No attempt was made to search for a causative agent of syphilis, the diagnosis being made by the lesions having a different appearance from those of tuberculosis. The idea of my paper was that it should be largely suggestive. In the textbooks little attention has been paid to this subject. Recently there has been an attempt on the part of some to claim that the two diseases do not exist together. As suggested by Dr. Knight, one disease might retard the progress of the other; but exactly what influence one disease has upon the other I do not know.

WHAT MAY BE ACCOMPLISHED WITH APPARENTLY HOPELESS CASES OF TUBERCULOSIS

By Sherman G. Bonney, M.D.

Denver

In view of the interest attaching to the tuberculosis problem, it is, perhaps, fitting to call attention to one phase of the subject which has received hitherto but comparatively little attention. During recent years the organized effort of the profession has been concentrated largely upon the adoption and execution of preventive measures. As a direct result of systematic effort the mortality of the disease has diminished perceptibly, and society is becoming educated rapidly to a more or less intelligent conception of its nature. While much has been accomplished in the way of preservation of future communities, it is pertinent to inquire to what extent the welfare of the consumptive himself has been subserved by reason of concerted medical interest. The obligation upon the profession and upon society is no less toward those already afflicted with the disease than toward generations to follow. In the interests of the invalid, the most advanced phthisiotherapeutic thought has been directed toward supervisory control and the beneficial influence of climate.

It is hardly appropriate at this time to discuss ever so briefly climatic considerations, but it seems opportune to call attention to the limited scope of the sanatorium whose field of usefulness at present is not sufficiently broad to include the admission of advanced tuberculosis. Without desiring to detract in the least from the great utility of such institutions open to incipient pulmonary invalids, the fact remains that patients of this character do not as a rule constitute such a menace to society as the advanced cases, and are rarely so ill as to demand that degree of personal supervision which necessitates residing under the same roof with a resident physician and corps of assistants. Many of these with proper industrial opportunities and in a suitable climate

could easily become self-supporting. While added opportunities for recovery are being offered to incipient cases, it is difficult to comprehend in what manner recent clinical effort has benefited the apparently hopeless or far advanced consumptive. He is denied admission to all sanatoria, because his condition is not such as to comply with requirements stipulated in their blanks of admission. He is persona non grata to all municipal hospitals. It might almost appear that these unfortunates may profit from the recent agitation concerning consumption only to the extent of receiving a few educational leaflets telling them where to expectorate, how their bed linen shall be disinfected and how their apartments may be fumigated after death. He is privileged to be duly registered at headquarters and to receive instructions from some responsible medical source, but he is forced to appreciate the fact that he constitutes at best a source of danger to his family. He is told in his educational leaflets "to avoid the germs of consumption, to have a cheerful mind and a clear conscience, and to get an abundance of good food and good air," yet he is denied by virtue of his very needs and requirements those advantages which are freely bestowed upon others less worthy upon the score of their actual needs, and who constitute elements of far less danger to the public.

It is desired to emphasize the valid claim of the far advanced consumptive to receive a more sympathetic practical consideration than at present afforded. This obligation upon society is not discharged by the construction of hospitals to serve merely as a refuge for such cases until they are relieved of their sufferings. Equal sanatorium provision should be afforded as is given to incipient cases, and a no less active systematic endeavor toward securing arrest. Save under exceptional conditions no given case of tuberculosis should be pronounced absolutely hopeless. An intelligent prognosis is rarely made from the physical evidences alone. Most extensive and active tubercular infection, even in the presence of marked constitutional disturbances, the existence of cavities and other unfavorable complications, may nevertheless undergo a complete and enduring arrest. Clinicians whose experience has been confined to the observation of incipient cases in sanatoria may not be inclined to accept this statement, but those who have enjoyed the varied experience rendered possible in health resorts will verify my conclusions.

It may not be inappropriate in justification of these remarks, to allude briefly to my personal experience in Colorado. I have been

privileged to observe more or less closely in private work seventeen hundred cases of pulmonary tuberculosis, whose records have been preserved. A more heterogeneous lot of consumptives it would be impossible to imagine. Many appeared absolutely hopeless upon arrival, some died shortly after, a vast number were in greatly impoverished circumstances. It may be of interest to state that the average period of delay following the recognition of the symptoms referable to the disease up to the time of their arrival in Colorado was twenty and one-third months. Sixty-nine and one-tenth per cent. had active extensive trouble in both lungs, fifty-three and one-half per cent. presented all the evidences of a profound constitutional disturbance, including the sepsis of secondary infection, marked emaciation with evidence of softening, and other symptoms and signs sufficient to occasion their classification as advanced cases. Eighteen per cent. of all these cases showed unmistakable evidence of cavity formation. The average loss of weight was 18.8 pounds. These statistics are computed from a critical analysis of seventeen hundred cases and may be accepted as definitely accurate. A large number have secured an entire arrest, by which is meant the absence of physical signs, and disappearance of the bacilli from the sputum. Some of the so-called far advanced cases, and a few who were apparently hopeless, are to-day enjoying an active business life. Detailed statistics are inadmissible at this time but will be submitted in a subsequent paper. I will report briefly a few illustrative cases to show precisely what is meant when statements are made regarding alleged recoveries of what were first considered to be hopeless cases.

Case 1. A woman twenty-four years old consulted me May 24, 1902, the day of arrival in Colorado, eight months after recognized symptoms of tuberculosis. Progressive rapid failure from the beginning; loss of over fifty pounds of weight. Chills daily with copious night-sweats. Average afternoon temperature from 102 to 103. Cough excessive, expectoration twenty-four hours four ounces, numerous bacilli. Marked dyspnea, pulse ranging from 120 to 140. Upon examination extensive infection of both lungs. In the left, signs of consolidation with fine moist rales after cough to the fourth rib in front, and from the apex to the base in the back. In the right numerous fine clicks from the second interspace to the base in front, and from the middle of the interscapular space to the base in the back.

On account of the extensive pulmonary involvement, the great emaciation, the long continued sepsis and an irritable nervous temperament an absolutely unfavorable prognosis was rendered. The urgency of the case was such that cardiac stimuation was constantly employed, and upon several occasions I was constrained to believe that she would not survive twenty-four hours. With

a beginning diminution of fever and circulatory disturbance at the end of six weeks, there gradually developed increase of appetite, digestion, strength and weight with lessening of cough and expectoration. Following a progressive improvement during a period of two years the patient was discharged as an arrested case and permitted to return home, having gained forty-three pounds in weight with the pulse in the neighborhood of 80, without cough or expectoration. Physical examination at that time disclosed entire absence of existing tubercular infection. There had resulted, however, extensive proliferation of fibrous tissue throughout the infected areas, giving rise to appreciable changes in pitch and quality of respiratory sounds without rales. She has remained at home over two years, and last advices showed no evidence of retrogression, in spite of the fact that she has given birth to two children since she left Colorado.

Case 2. A woman thirty-five years old arrived in Colorado in April, 1899, nearly five years after the recognized onset of her pulmonary infection. Loss of fifty-five pounds in weight, cough distressing and paroxysmal, high fevers daily, pulse varying from 130 to 160 at rest. She was unable to sit up in bed on account of embarrassed cardiac action, nourishment for weeks having been taken through a tube. Upon examination signs of extensive active tubercular infection of each lung, in the right upper front, cavity size of small orange with consolidation extending to the fourth rib, and in the back to lower edge of the scapular. In the left consolidation to the third rib and to the middle of the interscapula space. Throughout this entire region moist bubbling rales easily recognized on easy respiration.

A hopeless prognosis was unqualifiedly made. Her family physician who accompanied her to Colorado stated that she could survive but a week or ten days at most. She was kept in bed in the open air for nearly six months with liquid nourishment and nutritive enemata for two months. She remained under my constant observation for two years, during which time she exhibited a slow but remarkable improvement. During the first six months in bed she gained fifty pounds in weight, with a corresponding improvement in her general state, and in the condition of the lungs. At the time she was discharged there was a gain of nearly seventy pounds in weight but with a slight persisting bronchial cough. There was no moisture whatever recognized upon physical examination, though fibrous tissue changes were quite pronounced. She moved to a remote part of the state and continued to maintain her improvement until she died two years ago of acute appendicitis.

Case 3. A woman twenty-nine years old arrived in Colorado February, 1899, two years after developing marked symptoms of pulmonary tuberculosis. During this period she progressively declined, exhibiting emaciation, daily elevation of temperature, weak, rapid and irregular pulse, distressing, paroxysmal cough, copious expectoration with very numerous bacilli. Examination disclosed evidence of an active process involving a large portion of each lung. In upper right front cavity size of an orange in midst of an area of consolidation. Numerous bubbling rales from the apex to the fourth rib and in the back from apex to very base. On the left side consolidation with moist rales from the apex to the third rib. Moisture recognized in the left axilla, and in the back from the apex to the lower third of the interscapular space.

On account of the extensive pathological change, pronounced dyspnea, irritable pulse, hysterical temperament, poor appetite with frequent vomiting, an

ultimately hopeless prognosis was entertained without reserve, which opinion was indorsed by Dr. Babcock, who saw her shortly after her arrival in Denver. She has remained under my close personal observation during a period of eight years. During the first three years very little change was noted either in the general state or in the condition of the lungs. The cough was frequent and exhausting, expectoration copious and bacilli numerous. During the fourth year a beginning improvement was observed in her general condition, the physical signs remaining practically stationary. During the fifth year a gain of fifty pounds was made in weight, followed by an astonishing improvement in all respects. During the past three years she has continued to gain still further in weight and remarkably in strength. For over two years there have been no bacilli found in the sputum after a vast number of exhaustive examinations. There is a persisting bronchial cough at intervals with occasional expectoration. The examination of the chest shows no evidence of any existing tubercular process, although fibroid changes are readily detected.

Case 4. A young man aged nineteen, consulted me in May, 1899, his illness having developed ten months previously with acute pneumonic onset, involving the major portion of the left lung. The patient was sent originally to Las Vegas, New Mexico, in company with a physician and trained nurse, and two months later to Arizona where Koch's tuberculin was daily used for a prolonged period. Following an initial gain in the Southwest there ensued a persistent elevation of temperature, loss of weight and strength followed by several recurring hemorrhages. Upon arrival in Colorado there was a loss of thirty-two pounds in weight, temperature 104, pulse 120. Numerous bacilli in the sputum. Signs of massive consolidation left front apex to fifth rib with moist rales throughout. Semi-dry clicks in the left axilla. In the back bubbling rales to the very base, with area of consolidation extending to the middle of the interspacular space. On the right side slight consolidation at the apex, with moist rales to the second rib and an area of infiltration with moisture at the base. In the back partial consolidation at apex with fine clicks in interscapular space.

In view of the age, the active advanced process in one lung, the extending invasion of the other, the hemorrhagic tendency, persisting fever and rapid pulse, the prognosis could scarcely be other than distinctly unfavorable. There developed, however, a gradual resolution of the consolidation with lessened activity of the tuberculous process shown by slighter moisture, diminution of cough and expectoration, fewer bacilli and increase of weight and strength. Two years ago after five years constant medical attention, there was entire absence of cough and expectoration, the bacilli disappeared and he had gained nearly sixty pounds. Examination of the chest failed to indicate the existence of any tubercular activity whatever, there remaining only a somewhat prolonged high pitched expiration, tubular in quality at left apex without moisture. He shortly afterwards married and has resided half the time in Illinois. At present, seven years after coming under my observation, the arrest is complete.

Case 5. A boy nine years old arrived in Colorado June 1, 1903, exactly three months after the development of acute bronchitic symptoms. Following the initial onset he remained eight weeks in bed with a persisting fever and moderate cough. At the end of two months accompanied by his parents and family physician he was sent to New Mexico, remaining thirty days. During this entire period there had been a progressive rapid decline. At the time I saw

him he was greatly emaciated weighing exactly fifty pounds. Average afternoon temperature 101½, marked dyspnea on exertion, appetite exceedingly poor, pulse 124, persisting cough without expectoration. Signs of consolidation throughout the entire left lung, without moist rales upon easy respiration from the apex to base front and back.

In view of the age, the history of the development of an idiopathic pleurisy undoubtedly tubercular, the continued fever, the great emaciation and physical signs, an unfavorable prognosis was rendered. The exclusive care of the child was committed to a trained nurse and an unbroken regime was maintained for a period of two years and one month. During this time the child exhibited most remarkable improvement in spite of the fact that at the end of four months he contracted a typhoid fever of eight weeks duration, followed in the second year by an acute fulminating appendicitis operated during the first twenty-four hours. He was discharged as cured in July of last year, there being not the slightest trace of moisture to be recognized after repeated examinations of the chest although fibrosis was extensive. His general condition was excellent in all respects, his weight approaching eighty pounds. He has remained well ever since.

Case 6. A man forty-one years old came to Colorado in September, 1904, nine months after an acute pneumonia which was followed by severe persisting cough and continued fever with night-sweats. Meantime he had experienced a severe hemorrhage and lost much weight and strength. The sputum had been found to be loaded with bacilli. He gained eighteen pounds in a well-known health resort, but exhibited continued elevation of temperature with occasional chills and severe sweats. There was subsequent loss of weight, increased cough and expectoration, although he had been in bed during day and night for months. The case was pronounced by a pre-eminent authority to be entirely hopeless. Upon arrival in Colorado the examination of the chest disclosed extensive active tuberculous infection of each lung. On the right side moist rales were plainly heard in front to the third rib, and in the back from the apex to the very base. On the left side well-marked consolidation in the upper portion, with but slight moisture in front, but with coarse rales from the apex to the lower angle of the scapula in the back.

A further decline was exhibited for several weeks. The temperature was constantly elevated, chills and night sweats were frequent, and there resulted greater loss of flesh and strength. The cough was extremely distressing, expectoration copious with numerous bacilli, temperament markedly nervous, the patient apprehensive and discouraged.

The active disseminated tubercular infection, unmistakable evidence of sepsis, impaired digestion with entire absence of appetite, a weak and rapid pulse, and the general prostration, were sufficient to justify, almost without reserve, an unfavorable prognosis. After several months a gradual improvement was observed which has continued without interruption. In September, 1905, one year after coming West, there was but little or no expectoration, fever had been absent for many months, a gain of forty-five pounds in weight had been established, and the pulse was uniformly of good character. At the present time it is impossible to discover any physical signs attributable to an existing tubercular process, no moisture being recognized after careful exploration. Searching examinations of the sputum fail to disclose the presence of bacilli.

Case 7. A young lady eighteen years old consulted me June, 1896, imme-

diately upon coming to Colorado. Her illness was of one and one-half years duration, during which time she had spent several months in the White Mountains and in Asheville. There was great emaciation and pallor, dyspnea upon the slightest exertion, nausea and daily vomiting with diarrhea, pulse 120 to 130 at rest, cough exceedingly severe, expectoration purulent and copious. Upon examination the entire left lung was found to be involved. Signs of pronounced consolidation throughout, coarse bubbling rales on easy breathing from apex to base front and back. Cavity nearly the size of the fist in the left upper front.

There was nothing in the history or condition to furnish a warrantable basis for the slightest encouragement. Her age was against her, she was profoundly septic and her powers of resistance were evidently exhausted. Cavity formation had already taken place, and softening was rapidly going on in a lung partially consolidated from top to bottom. She has remained under my management during the ensuing ten years. Without entering into a tedious recital of the details of her progress I will state that during the greater portion of this time she was made to follow a scrupulous regime with resulting improvement noted from time to time, despite the fact that her circumstances were limited and only absolute necessities permitted. Eight years of unremitting toil and patience sufficed to bring about a complete arrest. There was but little cough, and the expectoration was essentially bronchial in character. She had gained forty-three pounds in weight, had shown no constitutional symptoms for one or two years, and the examination of the chest revealed no evidence of existing tubercular activity. Examination of the sputum was found to be entirely negative. She was married to an army officer very shortly afterwards, and for the past two years has led the gay and strenuous social life incident to an army post. At the time of her departure for the Philippines with the Second Regiment recently, I was privileged to make an exhaustive physical examination. In spite of her late hours of social dissipation it was found that there had developed no renewed activity of her former tuberculosis. A large cavity persisted in the upper left front without moisture. No rales could be heard in any portion of the lung, which was found to have undergone through the lapse of years extensive fibrosis. Some sputum was occasionally expectorated. This was subjected to examination with continued negative results.

The foregoing cases are selected from many which might be reported to illustrate the possibility of complete recovery even in apparently hopeless cases of tuberculosis, the arrest in these instances being thus far enduring and complete.

I will now cite three more instances, all of recent origin, to illustrate even more emphatically than the preceding the results possible of attainment in extremely desperate cases.

Case 1. A woman twenty-seven years old placed herself under my care in March, 1905, two years after the beginning of her illness. At the time of arrival there was a loss of twenty-two pounds in weight in an individual of small stature. Night sweats had been persistent for four months, as had a daily afternoon temperature of 103, preceded in each instance by a severe chill. Cough very severe, expectoration in twenty-four hours about six ounces, dyspnea pro-

nounced, pulse averaging 140 in bed. Active involvement of entire left lung from apex to base front and back. Throughout this region coarse bubbling rales with small cavity in upper interscapula space. In the right lung slight consolidation at apex with moist rales to the fourth rib. Prognosis apparently hopeless. She declined rapidly for the ensuing three months, meantime developing a left sided pneumothorax which almost terminated her existence. During my absence from town she was cared for by Dr. Sewall who agreed with me that her case was not only beyond hope, but that she could scarcely live to be sent home. She has now gained twenty-five pounds in weight with only occasional slight elevations of temperature, is able to exercise moderately and has a pulse ranging from 80 to 90. The signs of tuberculous infection have entirely disappeared from the right side. On the left side there still persists a circumscribed and closed pneumothorax with some moisture remaining in the uncompressed portion of the lung. No physician would at present regard her as a hopeless case.

Case 2. A boy seventeen years old consulted me April, 1905, one year and three months after residing in Colorado under constant medical supervision. At no time during his stay here had he shown the slightest improvement. During the last six months the diurnal variation of temperature in no day had been less than five degrees. There was great emaciation, marked dyspnea, frequent cough and expectoration, severe digestive disturbance with tubercle bacilli in the bowel discharges as well as in the sputum, pulse 120 in bed. His physician had recommended his immediate return home, although such a move would have been attended with some difficulty. The examination of the chest showed very active and extensive tubercular processes in each lung, on the left side coarse bubbling rales from the apex to base front and back with large cavity in upper portion. On the right side medium-sized moist rales from apex to fifth rib and to spine of scapula in the back.

An absolutely unfavorable prognosis was rendered, but active measures were instituted in his behalf. During the first eight weeks he declined still further, at one time his weight reaching ninety pounds, although six feet in height. He has been kept constantly in bed out of doors and has established a remarkable improvement. Digestive disturbances have largely disappeared. He takes a prodigious amount of nourishment, has gained exactly thirty pounds, has at no time any elevation of temperature and the pulse is invariably under 90. The physical signs have disappeared from the right lung and there is very much less moisture in the left. There is very little expectoration, several days frequently elapsing without the slightest cough. Bacilli, though still found in the sputum are decidedly attenuated. I look for the ultimate complete arrest of the tuberculous process.

Case 3. The last case to be reported is a young lady twenty-two years old, coming under my care in April, 1905. Her illness at that time had been of nearly nine months duration exhibiting throughout a progressive decline. In his letter of introduction her physician wrote: "Miss Blank has a very rapidly advancing tuberculosis. We can hold out no hope of recovery." He further stated, "at the time she entered our sanatorium she had already lost twenty-five pounds in weight, was very anemic with elevation of temperature, rapid pulse, tuberculous deposit in the left lung with moist rales from apex to base. Beginning involvement of the right apex with superficial ulceration of both

vocal cords. All her physicians and consultants have advised against the journey." Upon examination of the chest it was found that the left lung was diseased from apex to base, with a moderate sized cavity in the upper portion with pronounced tubercular signs in the right. Like the two preceding cases the patient showed no evidence of improvement for several months, her weight receding to eighty-six pounds. The sepsis finally became less pronounced, the temperature gradually subsided with consequent improvement of appetite and digestion. She has gained exactly thirty-three pounds and up to the time of a recent influenza infection has shown no elevation of temperature at any hour of the day, for four or five months. Her pulse has been about 80, cough and expectoration diminished, strength much increased. Upon examination there is no evidence of tubercular trouble upon the right side, and the signs upon the left are considerably less active.

At the time of the meeting of this Association one year ago, these cases were in as desperate and apparently hopeless condition as can possibly be imagined.

This remarkable series of cases is reported in justification of the belief that a permanent arrest of the tuberculous infection is sometimes possible, even in those cases which may be regarded at first as utterly hopeless.

In connection with these reports there are several important facts to be borne in mind: (1) That these cases are selected merely to illustrate the possibility of arrest in far advanced cases, and that numerous other instances equally as striking can be adduced from my own personal experience. (2) That the cases here described represent not simply what might be regarded as decidedly unfavorable cases, but were considered without exception, by other physicians as well as myself, as being utterly hopeless by virtue of every consideration which may ordinarily influence prognosis. (3) That with the exception of the last three cases reported, which are of very recent origin, the remaining seven have not simply undergone improvement with the ultimate outcome as yet uncertain, but have actually experienced a complete arrest of the tuberculous trouble, with entire absence of physical signs, sputum and bacilli, with a complete restoration to former usefulness and activity. (4) That the necessity for the practice of strict economy has been no insuperable barrier to the acquirement of complete arrest in a suitable climate and under proper régime. (5) No claim is made that the results obtained were entirely referable to climatic influences. It is contended, however, that such results in equally desperate cases are impossible of attainment in what may be regarded as relatively unfavorable climates, no matter how perfect the régime. (6) No

special methods of treatment were employed other than those familiar to every physician of experience in the management of pulmonary tuberculosis. (7) No credit for results obtained is assumed other than that which may relate to an unremitting personal attention to detail, according to the exigencies of the situation and an adaptation of means to ends at times somewhat radical. (8) No case is here reported that is not entirely subject to confirmation by the attending physicians whose names are not cited in the report.

As logical conclusions from such results, it may be stated, first, that no physician can assume with positiveness to pronounce death sentence upon any case, no matter how desperate the apparent extremity. Second, that each case is therefore entitled strictly on its merits to a determined, painstaking and aggressive effort to secure arrest.

It follows that while the rich are abundantly able to combat the disease through such means as their medical advisers may counsel, the poor, deprived of such advantages, are justly entitled at the hands of the state to adequate hospital provision in an effort to preserve life, rather than to be merely instructed as to the proper method of passing their remaining days.

A CONTRIBUTION TO CLIMATIC PHTHISIOTHERAPY

By E. S. Bullock, M.D.

Silver City, N. M.

(Read by title.)

During recent years there has been a very animated discussion among phthisiotherapists regarding the merits of climate as an adjunct to the treatment of various forms of tuberculosis. To my mind the most apt and at the same time conclusive utterance on this subject is that made by Dr. F. I. Knight, of Boston, during the discussion of the report of the committee on climate at the 1905 meeting of the National Association for the Study and Prevention of Tuberculosis. He says: "It is strange that the factors of climate should have no effect upon the individual with tuberculosis when they certainly do have effect upon him when he has not tuberculosis." He also says: "It has not yet been found out what can be done with sanatorium treatment in different climates." In the following pages it is my intention to present evidence directly bearing upon Dr. Knight's statements.

This evidence consists of the protocols of one hundred and forty-eight cases taken dircetly as they come without selection from my records. Comparison of the results achieved with those obtained by similar methods and under like conditions in so-called unfavorable climates should not be difficult and should be of real value in the final settlement of the vexed question "climate in tuberculosis."

The protocols are as brief as is consistent with fair representation. The results of the first and last examination are given, with the salient features in each case. All were treated in closed institutions exclusively for tuberculosis by the usual and at present classic method. Careful individualization has been an important feature of treatment. The person rather than the disease has been ever in mind. For the

sake of clearness it is well to state that there has been no attempt at specific medication.

In laryngeal tuberculosis a method has been employed which I believe is unique in some features, and the results obtained, it seems to me, justify a more extended trial than I have been able to give it. Patients presenting this complication have received local treatment twice daily. The larynx is first thoroughly cleansed with a solution of tar-water and sodium bicarbonate. It is then well mopped with a solution of formalin in water as strong as can be borne, usually beginning with one or two drops to the ounce of water, increasing gradually to eight or ten drops to each ounce of water, which makes as powerful a solution as I have found it desirable to employ. I wish to state most emphatically that I have never had a case in which I could not remove the pain of deglutition by this method. The curative influence of this method is marked. It is, however, well to state, that in a failing patient nothing except relief of pain can be accomplished. In laryngeal tuberculosis the diagnosis has usually been made by the specialist by whom the case has been referred before coming into my hands.

Finally there will be found a statistical summary in the hope that the results and data there presented, backed by the protocols themselves, will at least go a little way towards the elucidation of the problem "climate in tuberculosis."

The Climate of the Silver City Region.

Dryness of the atmosphere is a marked feature of our climatic state, to which the semi-aridity testifies. The aridity is not, however, so marked as in more desert parts of the southwest. There is low relative humidity with moderately low temperature. The shade temperature in summer rarely exceeds ninety degrees F., and does not, of course, average nearly as high. The sensible temperature, on account of the absence of humidity, is much lower than the actual. The summer nights are distinctly cool. We who live here are unanimous in the opinion that our summers are delightful. Winter nights are cold, the temperature often going ten or fifteen degrees below freezing. Winter, however, is a short season as a rule, beginning about the middle of December and ending about the middle of February. A clearly marked spring and fall we do not have, but rather jump from summer to winter and from winter to summer. During the winter, when the sun is shining,

an overcoat is a superfluous garment, and during an average winter we can keep patients on cots out of doors with but one blanket over them. It never freezes when the sun shines.

The air being that of a mountainous and sparsely settled region, is, as might be expected, very pure. In the old days before Fort Bayard was converted into a sanatorium it was said to have the lowest sick-report of any post in the United States Army. This is excellent testimony regarding the purity of the air. Along this line I might add that I have never seen mixed infection develop here. In common with the whole southwest there is a very high proportion of days during which the sun shines either all or part of a day.

The altitude is six thousand feet, and here I should like to state that I recognize but four reasons for sending a patient to a lower altitude: First and most important, because he is not doing well; second, because he is cyanotic; third, because he cannot breath comfortably, and fourth, because he cannot sleep. All of these are valid reasons for seeking a lower altitude, and none of them can be prognosticated. Trial alone will make them plain.

There is a high mobility of the atmosphere; it is a windy country, but because we have turf all over we do not have dust or sand storms. At all times of the year there is a great range of temperature. The difference between night and day, sun and shade is always marked. The soil is a sandy clay, adobe, and because the country is very steep, a fall of over three thousand feet in fifty miles, and because of a high rate of evaporation, the soil drys rapidly even after a very hard rain. The so-called rainy season consists of heavy showers two or three times a week during the month of August and a part of September and July. They usually occur in the late afternoon.

Such is the climatic environment in which the following cases were treated:

CASE 1. Male, age 27; physician; presented symptoms during previous six weeks. Wt. 108 lbs. Average daily maximum temperature 101° F. Cough and expectoration slight. T. b.'s present. Two very slight hemorrhages during treatment. One year under treatment. Small area of infiltration below left clavicle without rales. Result: Wt. 150 lbs. Temperature normal. No cough or expectoration. Sputum negative. Temperament fairly co-operative. Finances adequate. After six years still in good health. Lives West. No pulmonary signs.

CASE 2. Male, age 27; farmer. Tuberculosis history four months. Wt. 117 lbs. Average daily maximum temperature 100° F. Cough and expectoration slight. T. b.'s present. Two years under treatment. Infiltration of right apex to below first rib. Rales. Result: Wt. 190 lbs. Temperature normal. No cough

or expectoration. Sputum negative. Temperament favored cure. Finances adequate. Six years later in good health. Is now a hard drinker. Lives West. Signs of slight increase of density over former lesion.

CASE 3. Male, age 43; no occupation. Tuberculous history two years. Wt. 132 lbs. Cough and expectoration moderate. T. b.'s present. Temperature normal. Under treatment twenty months. Consolidation of right apex to second rib, dry. Infiltration posterior left base, rales. Result: Wt. 165 lbs. Temperature normal. Cough and expectoration about the same as on admission. T. b.'s present. Pulmonary status practically unchanged. Temperament favorable. Finances adequate. Five years later alive and has fair health. Lives West.

CASE 4. Male, age 26; teacher. Tuberculous history fifteen months. Wt. 114 lbs. Average daily maximum temperature 101½° F. Cough and expectoration very slight. Night sweats. T. b.'s present. Tuberculous sinus to sternum, eighth left rib, and one leading to left kidney, following operation upon that organ. Tuberculosis of bladder, left ureter, and left testicle. Diagnosis made by a number of specialists. Under treatment twelve months. Slight infiltration of right apex to below first rib. No rales. Result: Wt. 150 lbs. Temperature normal. No cough or expectoration. Sputum negative. Temperament great assistance in treatment. Finances adequate. All sinuses healed. Left testicle still hard. Cystoscopic examination negative. Four and a half years later well and working. Lives West. No pulmonary signs except slight increase in density over former lesion.

CASE 5. Male, age 23; physician. Tuberculosis followed pneumonia of left lung six months previously. Wt. 111 lbs. Cough and expectoration marked. T. b.'s present. Average daily maximum temperature 103° degrees F. Night sweats. Nearly died of hemorrhage shortly after admission. Was nine months in bed. Under treatment almost two years. General infiltration of left upper lobe. Consolidation of left lower lobe. Large cavity posterior in lower lobe. Rales all over the lung. Result: Wt. 171 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Temperament great assistance in treatment. Finances adequate. Four years later in good health and working. Signs of increase of density throughout the left lung. Cavity unchanged. No rales. Lives West.

CASE 6. Male, age 24; clergyman. Tuberculous history six months. Wt. 127 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration slight. T. b.'s present. Under treatment eighteen months. Slight infiltration of the right apex to lower margin of first rib. Rales. Result: General condition good. Wt. 150 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Temperament favored cure up to a certain point. Decided to go to work. Since then chronic advance. Finances adequate. Five years later works and takes excellent care of himself. Now has cavity and disease of both lungs. Fair general health.

CASE 7. Male, age 27; engineer. Tuberculous history six months. Wt. 136 lbs. Average daily maximum temperature 99.4° F. Cough and expectoration moderate. T. b.'s present. Under treatment four months. Consolidation left apex, and infiltration remainder of left lung. Infiltration right apex to below first rib. Rales all over lesion. Result: General condition good. Wt. 162 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Was a good patient, but ran out of money and went out in the country to camp. Soon lost

all he had gained. Failed slowly and constantly and went home to die four years later. Right apex dry. Rales over left lung much diminished. Consolidation left apex cleared.

CASE 8. Male, age 36; manufacturer. Tuberculous history about ten years. Wt. 123½ lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Under observation two weeks when he concluded that his business interests were of greater importance than his health, and he returned to his home in the East where he has attended to a large business for the past four years without any further impairment of health. Slight increase of density of right apex. Slight infiltration left apex and lower left lobe. Rales all over lesion of left lung.

CASE 9. Female, age 34; typewriter. Tuberculous history six years. Probable infection through a sister. Wt. 114 lbs. Three months under treatment. Temperature normal. Cough and expectoration slight. T. b.'s present. Signs of slight infiltration over both apices, and right lower and middle lobes. Rales over lesion of lower and middle lobes. Result: Wt. 126½ lbs. General condition very good. Temperature normal. Very little expectoration. No cough. Sputum negative. Not a tractable patient. Homesick and poor. Would probably have failed if a longer fight had been necessary. Infiltration of lower right lobes entirely cleared. Signs of slight increase of density over apices. Four years later in good health. Lives West.

CASE 10. Male, age 16; clerk. Tuberculous history one year. Average daily maximum temperature 101° F. Wt. 108 lbs. Cough and expectoration moderate. T. b.'s present. Mitral regurg. Rapid heart action. Fistula in ano. Under treatment two years. Consolidation right upper lobe, left lung to third rib, and infiltration right lower lobe posterior; scattered infiltration middle lobe anterior. Rales all over lesion. Result: During the first year improved constantly. Grew rapidly and gained to 134 lbs. Temperature normal. Dependent upon charity of institution. At the end of a year felt well enough to go to work. After a few months developed genito-urinary tuberculosis. Returned to institution and failed constantly until death. During last few months of life developed a laryngeal tuberculosis, which never went to ulceration. Temperament favored cure. During the first year lungs cleared wonderfully, and rales were much diminished. Consolidated areas cleared, and during the year of failure due to other causes he never retrograded in pulmonary condition.

CASE 11. Female, age 22; no occupation. Tuberculous history two years. Wt. 95 lbs. Temperature normal. Cough and expectoration moderate. T. b.'s present. Under treatment two months. Infiltration right upper lobe and left apex to first rib. Rales all over lesion. Result: Wt. 103½ lbs. Temperature normal. Cough and expectoration much diminished. Sputum negative; one examination. Became homesick and returned East. Three years later in Florida for her health. Finances adequate. Pulmonary status unchanged.

CASE 12. Female, age 32; no occupation. Tuberculous history ten months. Wt. 137 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Laryngeal infiltration. Under treatment three months. Very slight infiltration right apex. No rales. Result: General condition good. Wt. 149 lbs. Temperature normal. Cough and expectoration unchanged. T. b.'s present. Pulmonary and laryngeal status unchanged. Became homesick and dissatisfied

with sanatorium life. Finances adequate. Two years later heard that she had good health in her eastern home. Temperament unfavorable to cure.

CASE 13. Male, age 33; physician. Tuberculous history three years. Extensive exposure to tuberculosis in family. Gouty habit. Wt. 129½ lbs. Average daily maximum temperature 99.6° F. Marked cough and expectoration. T. b.'s present. Fistula in ano. Under treatment six months. Consolidation right apex to below second rib. Small cavity. Infiltration left upper lobe to bottom of fourth rib. Rales all over lesion. Result: Wt. 127 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration unchanged. T. b.'s present. Left because of limited finances and also as he was not doing well. Pulmonary condition practically unchanged. Not quite so many rales. Four years later developed genito-urinary tuberculosis. Is still alive. Lives West.

CASE 14. Male, age 45; farmer. Tuberculous history four months. Constant fever. Average daily maximum temperature 102.5° F. Grossly emaciated; too ill to weigh. Chronic alcoholic gastritis. Could not take solid food. Under treatment ten days. Cough and expectoration very marked. T. b.'s present. Result: Sent home as soon as condition was studied. Never should have come West. Finances adequate. Consolidation of the right upper lobe with large cavity upper part. Infiltration remainder of right lung and left apex to third rib. Rales all over lesion.

CASE 15. Male, age 33; merchant. Tuberculous history three years. Constant fever. Average daily maximum temperature 103° F. Diarrhoea. Fistula in ano. Night sweats. Cough and expectoration marked. T. b.'s present. Under treatment twenty days. Grossly emaciated. Too ill to weigh. Consolidation right upper lobe. Infiltration remainder of both lungs except posterior right base. Rales all over lesion. Result: Too ill to send home. Died under treatment. Never should have been sent West.

CASE 16. Female, age 28; housewife. Asthma. Tuberculous history one year. Wt. 75 lbs. Cough and expectoration marked. T. b.'s present. Night sweats. Under treatment six months. Average daily maximum temperature 100° F. Infiltration right apex to second rib. Consolidation left apex to first rib, and infiltration remainder of left lung. Rales general over lesion. Result: During the fifth month developed empyema on good side. Tapped for pressure symptoms and died upon return of pus. Should not have been sent West. Temperament favored cure and finances adequate.

CASE 17. Male, age 24; clerk. Tuberculous history six months. Wt. 141½ lbs. Average daily maximum temperature 99.4° F. Cough and expectoration moderate. T. b.'s present. Under treatment nine months. Consolidation right upper lobe with small cavity. Infiltration remainder of right lung and left apex to first rib. Rales all over right lung. Did very well until middle of sixth month when he had a slight hemorrhage following quarrel with another patient. There were several subsequent small hemorrhages with development of miliary tuberculosis. Result: Discharged in hopeless condition and lived but a few days after return home. Temperament favored cure. Finances inadequate. Partly supported by institution. Right lung about the same as on admission. Left lung generally infiltrated with rales all over. Cavity much increased in size.

CASE 18. Male, age 32; broker. Tuberculous history ten years. Wt. 111 lbs. Average daily maximum temperature 99.6° F. Marked cough and expectoration.

T. b.'s present. Tuberculosis of left testicle and right hip. Had been an invalid for years and several years in the West. Under treatment one year. Organism hopelessly impaired. Emphysema. Functional heart murmurs. Very large cavity left apex. Consolidation right upper lobe. Lesion dry. Result: Sent home on account of heart symptoms. Never any particular change in pulmonary status. Led a very faulty life on ranch before coming under observation. Temperament favored cure. Finances adequate. Badly advised before coming West. Died a few days after return home.

Case 19. Male, age 30; bookkeeper. Tuberculous history nine years. Wt. 105 lbs. Average daily maximum temperature 99.6° F. Marked cough and expectoration. T. b.'s present. Had been an invalid for years before coming under observation and had led a faulty, dissipated life. Had been advised that climate alone would cure him. Under treatment one year. Consolidation right upper lobe. Cavity right apex. Consolidation left apex down to second rib, bordered by infiltration to fourth rib. Rales of left side. Result: General condition a little improved. Pulmonary status practically unchanged four years later and under the influence of alcohol most of the time. Present time; terrible destruction in left upper lobe. Ulceration of trachea (Dr. E. F. Ingals). Suffers greatly, and how he continues to live is a mystery. Wt. at present 90 lbs. Finances adequate. Temperament unfavorable to cure.

Case 20. Male, age 21; student. Tuberculous history four months. Temperature normal. Cough and expectoration very slight. Sputum negative. Under treatment two months. Wt. 130 lbs. Slight infiltration both apices with rales. Result: General condition improved rapidly. Wt. 147 lbs. Temperature normal. Cough and expectoration disappeared. Concluded he was well enough to go home, contrary to advice. Finances adequate. Ultimate outcome unknown. Signs of slight increase of density over apices.

Case 21. Male, age 42; bartender. Syphilitic. Tuberculous history six months. Wt. 145 lbs. Temperature normal. Large quantity of foul-smelling sputum (pus). Repeated examinations of sputum negative. With the exception of occasional large moist or dry rale no pulmonary signs. Diagnosis putrid bronchitis. Under treatment two months. Result: General condition improved. Wt. 156 lbs. Sputum much reduced in quantity. Odor disappeared. Temperament favored cure. Finances inadequate. Returned home on this account. After return home had severe repeated hemorrhages, and three years later is said to be in good health.

Case 22. Male, age 29; insurance agent. Tuberculous history seven months. Night sweats. Average daily maximum temperature 99.6° F. Wt. 112½ lbs. Cough and expectoration marked. T. b.'s present. Atrophic rhinitis and pharyngitis. Under treatment one year. Consolidation left upper lobe to bottom of third rib with small cavity. Rales on this side. Infiltration right apex to second rib; dry. Result: General condition improved during first four months, but then progressive pulmonary and general failure began, and continued until he was sent home where he died a few months later. Finances inadequate. Temperament unfavorable to cure. Consolidation right upper lobe. Very large cavity left upper lobe. Very numerous rales over lesion.

Case 23. Male, age 32; clerk. Tuberculous history two years. Wt. 130 lbs. Average daily maximum temperature 99.4° F. Cough and expectoration marked. T. b.'s present. Under treatment one month. Had been in the West one and

one-half years. Consolidation right upper lobe. Infiltration right apex to bottom of second rib, and scattered infiltration both lungs anterior, with rales over lesion generally. Result: On account of poverty returned home where he died a year later. Temperament apparently favorable to cure. Instructed before coming West to take much exercise.

Case 24. Male, age 40; merchant. Tuberculous history probably about two years. Cough and expectoration very slight. T. b.'s present. Wt. 130 lbs. Temperature normal. Under treatment two months. Very slight infiltration both apices with rales. Result: Wt. 162 lbs. Temperature normal. Cough and expectoration practically ceased. Sputum negative. Rales disappeared. Signs of slight increase of density over apices. Temperament favored cure. Finances inadequate. Returned home and two years later had good health.

Case 25. Male, age 27; physician. Tuberculous history five years. Wt. 100 lbs. Average daily maximum temperature 100° F. Cough and expectoration marked. T. b.'s present. Under treatment two months. Consolidation right upper lobe. Partial infiltration middle lobe. Consolidation upper half of left upper lobe, with large cavity. Infiltration posterior right base. Some rales over lesion. Result: Dissatisfied with progress. Went from one health resort to another and died at the end of a year. Temperament unfavorable to cure. Finances inadequate. Should not have been sent West. Pulmonary condition practically unchanged.

Case 26. Male, age 37; farmer. Tuberculous history two and a half years. Had been a patient in some of the great sanatoria of Europe. Cough and expectoration slight. T. b.'s present. Temperature normal. Wt. 136½ lbs. Under treatment four months. An arrested case. Slight increase of density both apices and an old cavity left apex. Result: General condition improved. Wt. 140 lbs, otherwise the condition was the same as on admission. Returned to home in Florida and two years later in good health.

Case 27. Male, age 31; insurance agent. Tuberculous history fourteen months. Too ill to weigh. Emaciation gross. Average daily maximum temperature 103° F. Marked cough and expectoration. T. b.'s present. Night sweats. Under treatment four days. Mystery how he lived to arrive. Not sent by a physician. Consolidation of right upper and middle lobes. Infiltration of right lower lobes. Very numerous rales all over lesion. Result: Died in four days. Apparently killed by trip and high altitude. Cyanotic. Finances inadequate. Temperament?

Case 28. Male, age 23; lawyer. Tuberculous history six months. Went at once to Phoenix, Arizona. Apparently sent to me to get rid of him. Wt. 122 lbs. Average daily maximum temperature 102.5° F. Marked cough and expectoration. T. b.'s present. Under treatment five months. Had a series of small hemorrhages. Tried to get him to go home from the first. Consolidation right upper lobe and left apex. Infiltration remainder of right lung. Rales all over lesion. Result: Failed constantly and died under treatment. Finances adequate. Temperament very unfavorable. Universal disease of both lungs.

Case 29. Male, age 22; student. Tuberculous history five months. Wt. 133½ lbs. Cough and expectoration slight. T. b.'s present. Temperature normal. Under treatment three days. Did not like sanatorium life. Consolidation left apex to second rib, with rales. Infiltration right apex dry, and small patch of infiltration left lower lobe laterally, with rales. Result: Went down town.

Lived faulty life. Had a severe hemorrhage following exposure and died. Finances unknown. Temperament opposed to cure.

CASE 30. Male, age 35; bookkeeper. Tuberculous history three years. Peripatetic invalid. Cough and expectoration moderate. T. b.'s present. Temperature normal. Wt. 134 lbs. Under treatment one month. Consolidation right upper lobe to bottom of second rib. Dry. Result: Gained seven and one-half pounds second week. Then began to have fever to 100° F. each night, coincident with cavity formation. Became dissatisfied with progress and left institution to resume a wandering life in search of health. Temperament opposed to cure. Finances adequate.

CASE 31. Male, age 28; bookkeeper. Admitted in the midst of severe hemorrhagic period. During following three months had fifty-six hemorrhages, and was several times at the point of death. Temperature normal. Too ill to weigh for several weeks. Cough and expectoration moderate. T. b.'s present. Tuberculous history two years. One and a half years under treatment. Consolidation left upper lobes with immense cavity. Rales all over this lobe. Dry infiltration left apex, and moist infiltration left lower lobe posterior. Result: Improved slowly in general condition. Wt. 120 lbs. Temperature normal. Slight cough and expectoration. T. b.'s present. Discharged for misconduct (sexual relations with female patient). Temperament favored cure as long as he was severely ill and opposed to cure when he got up and about. Two years later enjoyed fair health and was working. Lives West. Right apex cleared. Signs of increased density over left upper lobe, but fair vesicular murmur everywhere, dry, and cavity much diminished in size. Few scattered rales over left lower lobe.

CASE 32. Female, age 20; housewife. Tuberculous history three years. Marked cough and expectoration. T. b.'s present. Average daily maximum temperature 101° F. Too ill to weigh. Gross emaciation. Extensive ulceration of larynx and epiglottis. Suffered greatly. Under treatment one week. Sent home as soon as condition was studied. Lived a few days after arrival home. Temperament? Finances adequate. Consolidation fairly general throughout left upper lobe, cavity at apex, and infiltration left lower lobe and right upper lobe. Rales general over lesion.

CASE 34. Female, age 38; teacher. Tuberculous history fourteen months. Cared for tuberculous sister seven years previously. Temperature normal. Moderate cough and expectoration. T. b.'s present. Under treatment six months. Wt. 113 lbs. Consolidation left upper lobe to third rib, with cavity. Infiltration remainder of left upper lobe and right apex to first rib. Rales general over lesion. Result: Wt. 137 lbs. Temperature normal. General health good. Cough and expectoration much diminished. T. b.'s present. Temperament favored cure. Finances inadequate. Went home on that account. Rales all disappeared. Consolidation and cavity remained. Infiltration of the right apex unchanged. Infiltration of the remainder of the left upper lobe cleared.

CASE 35. Male, age 18; student. Tuberculous history three months. Wt. 101 lbs. Average daily maximum temperature 102° F. Slight cough and expectoration. T. b.'s present. Long association with tuberculous mother. Under treatment less than a month. General slight infiltration of both lungs with fine rales everywhere. Result: Sent home where he died in a few weeks. Miliary tuberculosis. Temperament? Finances inadequate.

CASE 36. Male, age 35; merchant. Tuberculous history one year. Moderate cough and expectoration. T. b.'s present. Average daily maximum temperature

102° F. Under treatment six months at Loomis Sanatorium. General infiltration of larynx and epiglottis. Wt. 125 lbs. Under treatment six months. Consolidation right upper lobe, and infiltration left upper lobe down to fourth rib. Few rales both sides. Result: Soreness removed from larynx by treatment, but it remained unchanged in appearance. Remained in about the same condition for several months and then failed rapidly. Cough and expectoration increased. Lost weight and went home where he died a few months later. Temperament unfavorable to cure. Finances adequate. Consolidation right upper lobe with cavity. Consolidation upper half of left upper lobe with cavity. Infiltration middle lobe. Rales general over lesion.

Case 37. Male, age 36; merchant. Wt. 133 lbs. Marked cough and expectoration. T. b.'s present. Average daily maximum temperature 103° F. Tuberculous history fifteen months. Night sweats. Very feeble. Under treatment two months. Consolidation right upper and middle lobes, and left apex. Infiltration right lower lobe. Cavity right upper lobe. Rales general over lesion. Result: Failed constantly. Advised to return home from the first. Temperament favorable to cure. Finances inadequate. Died shortly after return home. No change in pulmonary status.

Case 38. Female, age 38; housewife. Tuberculous history two years. Wt. 105 lbs. Average daily maximum temperature 102° F. Night sweats. Genital and peritoneal tuberculosis. Under treatment four months. No pulmonary lesion. Result: Improved at first. Later failed. Went home and died after abdominal operation. Diagnosis confirmed by operation.

Case 39. Male, age 29; carpenter. Tuberculous history six months. Wt. 110 lbs. Temperature normal. Moderate cough and expectoration. T. b.'s present. Under treatment nine months. Consolidation right upper lobe and left apex to second rib. Cavity right apex. Infiltration middle lobe. Lesion dry. Result: Wt. 144 lbs. Temperature normal. Very little cough or expectoration. T. b.'s present. General health good. Supported by institution. Temperament favored cure. Left the institution to go to work and six months later developed tuberculosis of elbow joint following injury, and returned home for operation. Subsequent history unknown. On account of finances should not have been sent West. Signs of slight increase of density over lesion. No rales. Cavity unchanged.

Case 40. Male, age 29; physician. Tuberculous history nine years. Wt. 105 lbs. Very short of breath. Slightly cyanotic. Heart action very weak and rapid. Subject to tachycardia, pulse 150 to 180. Temperature normal. Moderate cough and expectoration. T. b.'s present. Under treatment six months. Had severe hemorrhages just before coming West. Consolidation left apex to second rib, bordered by infiltration to fourth rib. Infiltration right upper and middle lobes. Rales general over lesion. Result: Improved steadily. Weight increased to normal, 115 lbs. Temperature remained normal. Heart action improved. Cyanosis disappeared. During the fifth month had a series of severe hemorrhages, followed by marked cyanosis, shortness of breath and weak rapid heart action. On this account was advised to go to lower altitude and died on train apparently of heart failure. Temperament favored cure. Finances adequate. After the hemorrhage fine rales appeared all over both lungs.

Case 41. Female, age 37; housewife. Tuberculous history five years. Marked cough and expectoration. T. b.'s present. Wt. 106 lbs. Night sweats. Under

treatment one month. Average daily maximum temperature 100° F. Consolidation upper half of left upper lobe, with two small cavities. Infiltration right upper lobe, with consolidation of the apex. Rales general over lesion. Result: Very poor, partly supported by institution. Homesick. Temperament did not favor cure and financial condition precluded its possibility. Returned home. Subsequent history unknown. Lesion remained unchanged.

Case 42. Male, age 22; student. Tuberculous history four months. Average daily maximum temperature 99.6° F. Moderate cough and expectoration. T. b.'s present. Under treatment eight months. Consolidation right upper lobe—two cavities. Infiltration middle lobe and left apex. Rales general over lesion. Result: Improved a little at first in general condition and rales became less. Then remained the same until discharge for misconduct. Temperament opposed to cure. Finances adequate. Pulmonary status practically unchanged. Returned East. Did about as he pleased; drank, and lived two years.

Case 43. Male, age 36; machinist. Tuberculous history three years. Moderate cough and expectoration. T. b.'s present. Wt. 131 lbs. Temperature normal. Nine months under treatment. Consolidation right upper lobe. Infiltration middle lobe and left apex to first rib. Rales general over lesion. Cavity right apex. Result: Wt. 178 lbs. Six negative examinations, in seven just before discharge. Temperature normal. Cough and expectoration very slight. General health good. Finances inadequate, and on this account stopped treatment. Temperament favored cure. After leaving institution went on ill-advised camping trip. Contracted a cold and had a few small hemorrhages. Developed asthma. Went home discouraged and has led a partial invalid life since. Cavity almost healed. Consolidation of the right apex, and a few rales. Signs of increased density over lower part of right upper lobe and middle lobe. Left apex unchanged.

Case 44. Male, age 45; farmer. Tuberculous history two years. Slight cough. No expectoration. Came West after a hemorrhage. Temperature normal. Under treatment five months. Wt. 155 lbs. Slight dry infiltration right apex. Result: General health improved steadily. Wt. 167 lbs. Temperature normal. No cough or expectoration. Temperament unfavorable to cure. Finances adequate. Returned East and has enjoyed good health ever since. No change in pulmonary condition.

Case 45. Male, age 25; physician. Cigarette inhaler. Tuberculous history two years. Temperature normal. Cough and expectoration moderate. T. b.'s present. Under treatment three separate periods; first of nine months, second of two months, and third of three months. Came back first time for fever following hemorrhage, and the last time for pleuritic effusion of the left side. Tapped twice. First time one and a half quarts of serum withdrawn. Second tapping, a week later, one quart withdrawn. Wt. 129 lbs. Consolidation upper half of left upper lobe, with immense cavity. Infiltration, with rales right apex to second rib. Result: With the exception of setbacks mentioned improvement was steady from the first. Temperature normal. Cough and expectoration very slight. T. b.'s present. Wt. 157 lbs. Admirable patient. Finances adequate. Two years later in good health. Lives West and works. Signs of slight increase of density over right apex. Very small cavity at left apex, surrounded by small area of increase of density.

Case 46. Male, age 34; manufacturer. Tuberculous history six months. Temperature normal. Cough and expectoration very slight. T. b.'s present.

Had improved very much and gained fifty pounds under an eastern specialist. Under treatment one year. Wt. 194 lbs. Very slight dry infiltration right apex. Result: No cough or expectoration. Temperature normal. Wt. 190 lbs. General health excellent. Temperament favored cure. Finances adequate. Very slight increase of density right apex.

CASE 47. Female, age 43; housewife. Nephro- and enteroptosis. Tuberculous history one year. Hemorrhagic history marked. Moderate cough and expectoration. T. b.'s absent, over one hundred examinations. Possible pulmonary influenza or syphilis, though not probable. Temperature normal. Wt. 100 lbs. Under treatment four months. Slight infiltration right upper lobe and left apex to second rib. No rales. Result: General health improved. Temperature normal. Wt. 105 lbs. Cough and expectoration diminished. Sputum negative and perfectly characteristic of tuberculosis in appearance. Went to Denver to live and a year later had a hemorrhage. Passed fifteen milligram tuberculin test. Temperament favored cure. Finances adequate. Pulmonary status unchanged.

CASE 48. Male, age 46; grocer. Tuberculous history many years. Nearly died for lack of breath on striking the high altitude, and was at once sent home. Not examined.

CASE 49. Male, age 23; farmer. Tuberculosis followed smallpox four years previously. Wt. 142 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration moderate. T. b.'s present. Infiltration of larynx. Under treatment six months. Consolidation right apex. Infiltration remainder of right upper lobe. Infiltration left upper lobe to fourth rib. Few scattered rales over lesion. Result: At first improved, later stationary, and finally retrogressed. Wt. 140 lbs. Cough and expectoration increased. T. b.'s present. Average daily maximum temperature 100° F. Larynx unchanged. Temperament favored cure. Finances inadequate. Died one year later. Lesion slightly progressed.

CASE 50. Male, age 31; clerk. Winter cough since a boy. Tuberculous history six years. Severe cough. Moderate expectoration. T. b.'s present. Average daily maximum temperature 99.6° F. Under treatment five months. Infiltration of larynx. Admitted after hemorrhage. Wt. 148 lbs. Consolidation right upper lobe and infiltration left apex to second rib. Few rales right upper lobe. Result: Wt. 146 lbs. Average daily maximum temperature 99.6° F. Had one severe hemorrhage under treatment. Larynx unchanged. Cough and expectoration about the same. T. b.'s present. Temperament favored cure. Finances inadequate. Died at home a year and a half later. Pulmonary lesion extended to right lower lobe.

CASE 51. Male, age 22; merchant. Wt. 108 lbs. Average daily maximum temperature 102°. Very feeble. Marked cough and expectoration. T. b.'s present. Came in from a ranch where he had been some time. Disease followed pneumonia a year before. Tuberculosis of lower spine. Under treatment seven months. Consolidation right upper lobe with small cavity. Consolidation of left apex to fourth rib, with large cavity. Rales general over lesion. Result: Wt. 118 lbs. Improved steadily. Average daily maximum temperature 99.6° F. Cough and expectoration diminished. T. b.'s present. Left institution contrary to advice. Lived in the town for a year and did about as he pleased. Went to Denver and two years later I heard he was in hospital with severe hemorrages. Temperament favored cure when he was very ill, and opposed cure as soon as he improved. Finances adequate. Rales disappeared, otherwise pulmonary status was unchanged.

CLINICAL SECTION

CASE 52. Male, age 20; student. Run down condition following measles. Diagnosis of tuberculosis not confirmed. No cough or expectoration. Under treatment eight months and health fine.

CASE 53. Female, age 45; no occupation. Wt. 80 lbs. Temperature normal. Marked cough and expectoration. Tuberculous history one and a half years. T. b.'s present. Under treatment five months. Consolidation right apex to bottom of first rib. Infiltration remainder of right upper lobe. Right side dry. Consolidation left upper lobe apex to fourth rib with cavity at apex. Rales over lesion of left side. Result: Wt. 80 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration unchanged. T. b.'s present. Pulmonary status the same. Became homesick and went home where she died about a year later. Finances adequate. Temperament favored cure.

CASE 54. Male, age 20; student. Tuberculous history two years, most of the time in the Adirondacks under skillful treatment, though general course had been failure. Average daily maximum temperature 99.2° F. Wt. 134 lbs. Ulceration and infiltration of larynx. Under treatment seven months. Cough and expectoration slight. T. b.'s present. At no time did larynx become painful. Consolidation with cavity right apex to first rib. Infiltration remainder right upper lobe. Lesion dry. Result: About held his own for the first four months and then began to fail very rapidly. At last average daily maximum temperature 102° F. Cough and expectoration much increased. Wt. 108 lbs. T. b.'s present. Great destruction in larynx. Cavity right apex much enlarged. Consolidation whole right upper lobe. Infiltration middle lobe. Consolidation left upper lobe to fourth rib, with cavity at apex. Infiltration left lower lobe. Rales general over lesion. Temperament favored cure. Finances adequate.

CASE 55. Male, age 32; bank-examiner. Tuberculous history three years. Had done time in many health-resorts. Moderate cough and expectoration. T. b.'s present. Infiltration of the larynx. Tuberculosis of intestines. Diagnosis of intestinal complication confirmed by Max Einhorn. Fistula in ano. Average daily maximum temperature 100° F. Wt. 114 lbs. Very feeble. Had been instructed to take exercise. Under treatment five months. During second month, following severe pain, developed pneumo-thorax on the left side. Consolidation right upper lobe with rales. Consolidation left upper lobe down to fifth rib with rales and an immense cavity. Result: Following the development of pneumothorax the physical signs were practically obliterated. Never any change on the right side. Failed slowly and lost weight. Temperature remained about the same. Sent home and lived two years in great distress. Temperament favored cure and finances adequate.

CASE 56. Male, age 30; bookkeeper. Tuberculous history eight years. Had been in many health resorts. Marked cough and expectoration. T. b.'s present. Wt. 107 lbs. Average daily maximum temperature 99.6° F. Tuberculous enteritis. Under treatment two months. Consolidation right upper lobe with small cavity. Infiltration remainder of right lung. Consolidation left upper lobe to second rib, with small cavity. Infiltration remainder of left upper lobe. Rales general over lesion. Result: Wt. 106 lbs. Average daily maximum temperature 100° F. Condition about the same. Advised to go home where he died some months later. Temperament favored cure. Finances adequate. Cavity right upper lobe enlarged; otherwise condition of lungs unchanged.

CASE 57. Male, age 33; druggist. Tuberculous history six months. Wt. 141½ lbs. Slight infiltration of larynx. Temperature normal. Slight cough and expec-

toration. T. b.'s present. One hemorrhage during treatment. Under treatment eight months. Slight dry infiltration right apex. Result: Following the hemorrhage there was always a tendency to a little rise of temperature on exertion. Never any apparent change in pulmonary condition, or in cough or expectoration. T. b.'s present. On account of financial condition went to work and held his own for several months. Then began to fail rapidly. Had abscess in ear and finally died. No change in larynx. Temperament favored cure.

CASE 58. Female, age 24; no occupation. Tuberculous history four months. Wt. 92 lbs. Cough and expectoration slight. T. b.'s present. Temperature normal. Under treatment two months. Consolidation left apex to first rib, bordered by infiltration to second rib. Infiltration right apex to second rib. Few scattered rales over lesion. Result: Wt. 96 lbs. Temperature normal. Cough and expectoration very slight. T. b.'s present. General and pulmonary condition improved. Rales disappeared. Discharged for irregular sexual relations with male patient. Temperament unfavorable to cure. Finances adequate.

CASE 59. Female, age 23; no occupation. Tuberculous history one year. Wt. 84 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration moderate. T. b.'s present. Mitral regurg. murmur. Under treatment five months. Pulse 140. Consolidation right apex. Infiltration right upper lobe. Infiltration left apex to second rib. Few rales over lesion. Result: Pulse 90. Wt. 101 lbs. Temperature normal. Cough and expectoration very slight. T. b.'s present. Temperament favored cure, and finances inadequate. Left institution on that account. Lived in the town a year and about held her own by keeping very quiet. Had rather a hard time as regards care, food, etc. Finally developed an abscess of the rectum and was sent home on that account. Entered an eastern institution and since then, with the exception of one severe hemorrhage, has done very well. Now weighs 120 lbs. Lesion improved very much before she left institution. Consolidation cleared and very few rales on left side.

CASE 60. Male, age 24; student. Tuberculous history two years. Wt. 133 lbs. Moderate cough and expectoration. T. b.'s present. Average daily maximum temperature 100° F. Under treatment one month. Consolidation left upper lobe with immense cavity. Consolidation right upper lobe. Infiltration left lower lobe. Patch of infiltration right lower lobe anterior. Small effusion left side. Rales general over left side. Result: Considered hopeless and sent home where he died some months later. Temperament favored cure. Finances adequate. No change in pulmonary condition.

CASE 61. Male, age 30; contractor. Tuberculous history seven months. Knocked about El Paso doing the wrong thing for six months before coming under treatment. Under treatment one year. Average daily maximum temperature 99.6° F. Wt. 136 lbs. Moderate cough and expectoration. T. b.'s present. Dry infiltration of both apices to bottom of first rib. Patch of infiltration left upper lobe anterior lower part, with rales. Result: Improved from the first and gained weight wonderfully. Wt. 237 lbs. Temperature normal. No cough and practically no expectoration. Sputum negative. Temperament favored cure. Finances adequate. Two years later in good health. Slight signs of increased density over left apex.

CASE 62. Male, age 26; clergyman. Tuberculous history one year. Wt. 170 lbs. Temperature normal. Previous year in Arizona. Cough and expectoration slight. T. b.'s present. Under treatment five months. Slight dry infiltration

both apices. Patch of infiltration lower part of left upper lobe with rales. Result: Wt. 178 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Temperament unfavorable to cure. Finances adequate. Could not tolerate restraints of sanatorium life. Went back to Arizona where he remained another year. Cough and expectoration increased a little during the year in Arizona. Became disgusted with cure-hunting and returned home to Boston, where he has remained last eight months in about the same condition. At time of discharge from institution the lower lesion of left upper lobe had disappeared. Otherwise pulmonary condition was unchanged.

Case 63. Male, age 40; merchant. Tuberculous history twelve years. Average daily maximum temperature 100° F. Marked hemorrhagic history. Wt. 144 lbs. Had many hemorrhages and much blood-spitting during treatment. Under treatment two and a half years. Required one and a half years for temperature to come to normal. Emphysema a marked complication. Cyanotic during winters. High tension pulse. After each hemorrhagic period temperature would go up, but as time went on intervals between hemorrhages and febrile periods would be longer. Slight dry infiltration both apices. Left base seat of active infiltration. Result: Wt. 167 lbs. Temperature normal. Pulse high tension. Still short of breath on slight exertion. T. b.'s present. Admirable patient. Finances adequate. Became tired of one place and went to another institution. No rales at time of discharge, otherwise lesion about the same.

Case 64. Female, age 37; no occupation. Tuberculous history nineteen years, following chlorosis. Temperature normal. Much cough and expectoration. T. b.'s present. Extreme emaciation. Slightest exertion great loss of breath. Under treatment a few days. Consolidation left upper lobe; signs obscured by pneumothorax. Infiltration right upper lobe. Result: Advised to go home but went to Denver and died in a short time.

Case 65. Male, age 43; no occupation.Tuberculosis followed pneumonia and pleuritic effusion, five years previously. Marked cough and expectoration. T.b.'s present. Average daily maximum temperature 100° F. Wt. 114 lbs. Under treatment a few days. Had been in California previous year. Result: Advised to go home where he died in six months. Consolidation of left upper lobe with three cavities. Infiltration of the left lower lobe and upper half of right upper lobe. Rales over left lower lobe.

Case 66. Male, age 36; merchant. Tuberculosis followed appendicitis two years before. Average daily maximum temperature 99.6° F. Wt. 121 lbs. Marked cough and expectoration. T. b.'s present. Had been a peripatetic invalid for two years; all over the West. Under treatment a few days. Consolidation right upper lobe with small cavity. Consolidation upper half of left upper lobe with small cavity. Infiltration remainder of right upper lobe, middle lobe, and remainder of left upper lobe, and scattered rales over lesion. Result: Advised to go home where he died about a year later.

Case 67. Male, age 28; clergyman. Tuberculous history three years. Had been in many resorts in search of health. Severe hemorrhage in early history. Marked cough and expectoration. T. b.'s present. Average daily maximum temperature 100° F. It required eighteen months for temperature to come to normal. Larynx became involved a few months after admission and it required sixteen months twice daily treatments to bring it back to normal. Wt. 132 lbs. Twenty-eight months under treatment. Consolidation right upper lobe, and left upper

lobe down to third rib. Infiltration right, middle lobe. Scattered rales over lesion. Result: Larynx normal. Wt. 167 lbs. Temperature normal. Very little cough and expectoration. T. b.'s absent. General health excellent. Temperament favored cure in every way. Finances adequate. Signs of slight increase of density over apices.

CASE 68. Male, age 21; student. Tuberculosis followed pneumonia one year before. Admitted following severe hemorrhage. Average daily maximum temperature 104. Hemorrhages continued at frequent intervals until he died two weeks later. Fine rales all over both lungs with no other signs of pulmonary disease. Had been camping and taking exercise before he became acutely ill. Acute miliary tuberculosis. Finances adequate. Temperament unknown.

CASE 69. Male, age 35; merchant. Tuberculosis followed pneumonia two years before. Told by distinguished specialist he was too far advanced to come West. Temperature normal. Wt. 105 lbs. Moderate cough and expectoration. T. b.'s present. Under treatment one year. Infiltration right upper lobe with rales. Infiltration left upper lobe to fourth rib, with small patch of consolidation, with rales on this side. Result: Wt. 127 lbs. Temperature normal. General health good. No cough and expectoration practically absent. T. b.'s absent. Temperament favored cure. Finances adequate. Two years later in good health. Lives West. No pulmonary signs.

CASE 70. Female, age .25; housewife. Tuberculosis followed mastoid operation a year previously. Cough and expectoration slight. T. b.'s present. Ptosis of right eye followed operation. Average daily maximum temperature 101° F. Wt. 95 lbs. Under treatment four months. Dry consolidation right apex to second rib. Slight infiltration left upper lobe and posterior left base, with rales all over lesion. Result: Wt. 115 lbs. Average daily maximum temperature 99.4° F. General condition very good. Cough and expectoration unchanged. T. b.'s present. On account of financial condition went home. Temperament favored cure. Pulmonary condition unchanged.

CASE 71. Male, age 30; civil engineer. Tuberculous history one year. Moderate cough and expectoration. T. b.'s present. Infiltration of the larynx. Average daily maximum temperature 101° F. As sputum was loaded with streptococci and temperature remained high, streptolytic serum was administered and brought average daily maximum temperature below 100° F. Under treatment eight months. Wt. 140 lbs. Infiltration both apices to second rib. Rales general over lesion. Result: Wt. 162 lbs. Average daily maximum temperature 99.6° F. General condition much improved and very good. Larynx improved. Cough and expectoration a little increased. T. b.'s present. Temperament favored cure, but had a foolish wife who was not happy until she got him to go away. Died fourteen months later at his home in Michigan. Finances adequate. Rales disappeared from right apex. Left apex consolidated and a small cavity developed. Rales on left side.

CASE 72. Female, age 30; factory forewoman. Tuberculous history several years. Wt. 106 lbs. Average daily maximum temperature 100° F. Moderate cough and expectoration. T. b.'s present. Under treatment a few days. Consolidation left upper lobe, with rales and an immense cavity. Consolidation right apex to the second rib; dry. Infiltration of left lower lobe, with numerous rales. Result: Sent home as soon as condition was studied, where she died in a short time.

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CASE 73. Male, age 34; merchant. Alcoholic. Tuberculous history three months. Wt. 160 lbs. Average daily maximum temperature 100° F. Moderate cough and expectoration. T. b.'s present. Under treatment five months. Dry infiltration right apex to below first rib. Infiltration left apex, with rales, to third rib. Result: Great change occurred in left lung without corresponding symptoms. Apex consolidated and a small cavity developed. Infiltration spread throughout the remainder of the upper lobe, with numerous rales. Right apex unchanged. Average daily maximum temperature 99.4° F. Wt. 182 lbs. Cough and expectoration diminished. T. b.'s present. Temperament unfavorable to cure. Finances inadequate and on this account returned home where he died in sixteen months.

CASE 74. Male, age 28; physician. Tuberculous history seven months. Wt. 121 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Under treatment five months. Slight infiltration of the right apex. No rales. Result: Wt. 134 lbs. Temperature normal. Cough and expectoration absent. General health good. Temperament favored cure. Finances adequate. Two years later in good health. Lives West. No pulmonary signs.

CASE 75. Male, age 34; manufacturer. Tuberculous history three years. Came West the year before and in six months went home in very bad condition. Very high temperature. Was given streptolytic serum and rapidly improved. Was then sent to me. Moderate cough and expectoration. T. b.'s present. Wt. 121 lbs. Average daily maximum temperature 99.6° F. Under treatment nine months. Consolidation right apex. Infiltration remainder of right upper lobe. Infiltration left apex to third rib. Patch of infiltration middle lobe, anterior and posterior left base. Scattered rales over lesion. Result: Wt. 150 lbs. Passed several negative sputum examinations before t. b.'s were found. Temperature normal. Cough and expectoration much diminished. Temperament favored cure and finances were adequate. Returned home on advice of eastern physician and symptoms rapidly reappeared. Came back, but case has been progressive last two years. Lives West and works. At time of discharge had signs of slight infiltration over right apex.

CASE 76. Male, age 50; miner. Tuberculous history four years. Cough and expectoration moderate. T. b.'s present. Average daily maximum temperature 100° F. Wt. 146 lbs. Under treatment four months. Slight infiltration, with a few rales, right upper lobe. Result: Did very well until middle of the last month; gained weight, temperature came to normal. Began to expectorate blood. No actual hemorrhage; temperature went to 101° F.; became cyanotic, rapid respiration and died in a few days. Temperament favored cure and finances were adequate. Acute consolidation of the right upper lobe and signs of general infiltration over the remainder of both lungs, with numerous rales.

CASE 77. Male, age 28; merchant. Tuberculosis one year, following syphilis. Infiltration of the larynx, probably syphilitic, as it improved under mercury protiodide. Slight cough and expectoration. T. b.'s present. Wt. 162 lbs. Average daily maximum temperature 99.2° F. Under treatment four months. Slight infiltration, with rales, right apex to first rib. Marked infiltration, with rales, left apex to second rib, and slight infiltration, with rales, remainder of left lung. Result: Fewer rales over left lung, otherwise pulmonary condition the same. Temperature normal. Wt. 164 lbs. General health good. Slight cough and expectoration. T. b.'s present. Larynx about normal. Temperament very unfavorable to cure. Finances adequate. Impossible person. Requested to leave institution.

CASE 78. Male, age 49; bartender. Sent on mistaken diagnosis. Cancer of lung, liver, and stomach, confirmed by post mortem. Treated by Van Ruck for six months with "watery extract" for tuberculosis, and pronounced cured according to patient.

CASE 79. Male, age 17; student. Tuberculosis of lungs followed operation upon glands of neck six months previously. Temperature normal. Wt. 151 lbs. General health good. No cough or expectoration. Under treatment five months. Only sign of pulmonary disease cog-wheel breathing over left posterior base. Result: Continued to enjoy the best of health. No cough or expectoration, and no pulmonary signs. Temperature normal. Temperament favored cure. Finances adequate. Wt. 168 lbs. Returned home and has remained well.

CASE 80. Male, age 39; fireman. Anthracosis. Tuberculous history eight months. T. b.'s present. Perirectal abscess. Cough and expectoration slight. Wt. 156 lbs. Under treatment six months. Infiltration right upper lobe with a few rales posterior. Result: Wt. 190 lbs. Temperature normal. Cough and expectoration very slight. Several negative examinations before t. b.'s were found. General health good. Abscess healed. Sputum still black. Returned home on account of finances and went to work. Got wet at a fire. Had pneumonia. Began to fail and died in California one and a half years later. Temperament favored cure. Slight signs of increased density over right apex at time of discharge.

CASE 81. Male, age 27; teacher. Tuberculous history one year, and for previous year had been completely aphonic. Infiltration of the larynx. Moderate cough and expectoration. T. b.'s present. Average daily maximum temperature 99.8° F. Wt. 147 lbs. Under treatment six months. Consolidation of both apices, with infiltration of the remainder of the left upper lobe, right upper lobe and middle lobe. Fair-sized cavity right upper lobe posterior. Scattered rales over lesion. Result: Wt. 174 lbs. Temperature normal. General condition good. Cough and expectoration very slight. T. b.'s present. Larynx much improved and voice almost normal. Went home for financial reasons and general health has remained good for the past two years. Temperament favored cure. Cavity very small. Signs of slight increase of density over left apex and right upper lobe. No rales.

CASE 82. Female, age 21; housewife. History of several abortions. Wt. 119½ lbs. Tuberculous history four months. Average daily maximum temperature 99.6° F. Slight cough and expectoration. T. b.'s present. Under treatment six months. Consolidation right apex to the second rib. Infiltration remainder of right upper lobe. Consolidation left apex to first rib. Infiltration remainder of left upper lobe. Scattered rales over lesion. Result: Had appendicitis under treatment and made perfect recovery. Temperature normal. Wt. 137 lbs. General health good. Slight cough and expectoration. T. b.'s present. Temperament unfavorable to cure and finances inadequate. Rales mostly disappeared; otherwise no change in pulmonary lesion.

CASE 83. Male, age 48; political boss. History of albumen and casts for past twenty years. Wt. 155 lbs. Average daily maximum temperature 99.6° F. Marked cough and expectoration. T. b.'s present. Under treatment three weeks. Consolidation right upper lobe with rales. Result: Could not sleep and was sent to lower altitude. Subsequent course unfavorable. Temperament unfavorable to cure. Finances adequate.

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CASE 84. Male, age 24; student. Very poor constitution. Partial collapse of left chest following Eslander's operation. Improved in general health very much.

CASE 85. Male, age 37; salesman. Tuberculous history about one year. Marked cough and moderate expectoration. T. b.'s present. Infiltration of the larynx. Voice impaired. Emphysema a marked feature. Average daily maximum temperature 99.4° F. Wt. 126 lbs. Had hemorrhages during treatment. Under treatment nine months. General slight infiltration upper lobes of both lungs, with rales. Result: Wt. 134 lbs. Temperature normal. Very slight cough and expectoration. T. b.'s absent. Larynx normal. Voice normal. General health good, but very short of breath on account of emphysema. Sent to lower altitude in southwest where he remained six months. Then returned home and has maintained health for past year and a half. Very slight infiltration with a few rales at both apices.

CASE 86. Female, age 27; housewife. Tuberculous glands of neck. Tuberculous history four years. Wt. 104 lbs. Temperature normal. Slight cough and expectoration. T. b.'s present. Under treatment three months. Slight infiltration right apex with a few rales. Result: Wt. 116 lbs. General health good. Temperature normal. Practically no cough and very slight expectoration. T. b.'s present. Temperament unfavorable to cure. Finances adequate. Returned to her home in the East and has remained well since. No pulmonary change.

CASE 87. Male, age 20; collector. Tuberculous history three months. Average daily maximum temperature 103° F. Too ill to weigh. Grossly emaciated. Marked cough and expectoration. T. b.'s present. Under treatment a few days. Dry consolidation right apex. Infiltration left upper lobe with patch of consolidation anterior lower part, with cavity in the center and rales through the consolidated area. Very active infiltration of entire lower lobe. Result: Sent home as soon as condition was studied, where he died in a few weeks. Temperament unknown. Finances inadequate.

CASE 88. Female, age 24; no occupation. Wt. 126 lbs. Temperature normal. Very slight cough and expectoration. T. b.'s absent. Had a history of tuberculosis of the knee joint. Pulmonary history one year. Under treatment two months. Very slight dry infiltration right apex. Result: Wt. 131 lbs. Good health. No cough and very slight expectoration. Temperature normal. T. b.'s absent. Temperament unfavorable to cure. Returned home and maintained health last two years. Finances adequate. Signs of very slight increase of density over right apex.

CASE 89. Male, age 20; student. Tuberculous history three months. Very slight cough and expectoration. T. b.'s present. Temperature normal. Wt. 150 lbs. Under treatment six months. Very slight infiltration right apex with few rales, and middle lobe posterior, with a few rales. Result: Wt. 154 lbs. Temperature normal. General health good. No cough or expectoration. No pulmonary signs. Temperament favored cure. Finances adequate. Returned East and has maintained health one year.

CASE 90. Male, age 33; merchant. Tuberculous history eleven years. Marked cough and expectoration. T. b.'s present. Temperature normal. Wt. 127 lbs. Marked hemorrhagic history. Under treatment three months. Consolidation of right apex. Infiltration remainder of right upper lobe and middle and lower lobes anterior. Consolidation left apex, and infiltration, probably a good deal of fibrosis all over, of remainder of left upper lobe anterior. Few scattered rales over

lesion. Result: Wt. 144 lbs. Temperature normal. Cough and expectoration diminished. T. b.'s present. Left the institution contrary to advice to get married. With the exception of a few set-backs has been in fair condition past two years at home. Temperament very unfavorable to cure. Finances adequate. Alcoholic. With the exception of fewer rales, pulmonary condition unchanged.

CASE 91. Male, age 29; bookkeeper. Direct close exposure in caring for very sick tuberculous relative in California and Arizona. Tuberculous history eleven months. Average daily maximum temperature 100.4° F. Wt. 126 lbs. Very marked cough and expectoration. T. b.'s present. Ulceration of pharynx, larynx and epiglottis. Very feeble; grossly emaciated. Under treatment a few days. Pulmonary lesion with cavities, covered all of both lungs except the posterior left base. Rales universal. Result: Sent home where he died soon. Temperament unknown. Finances adequate. Should not have been sent West.

CASE 92. Female, age 18; singer. Examined by distinguished specialist through her clothes, and sent West. Had hemorrhages all the way, and died twenty-four hours after admission. Very advanced case, but never examined. Finances inadequate. Temperament unknown.

CASE 93. Fireman; age, 29. Very advanced, with oedema of feet and legs. Came West without medical advice. Not examined, but at once sent home, where he died in a few days. Temperament unknown. Finances inadequate.

CASE 94. Male, age 38; merchant. Tuberculous history several years. Came West following severe hemorrhagic period. Average daily maximum temperature 99.4° F. Marked cough and expectoration. T. b.'s present. Wt. 105 lbs. Disease masked almost entirely until the hemorrhagic period. Under treatment one year. Cavity right apex. Consolidation right upper lobe. Infiltration remainder of right lung, with rales lower lobes. Result: Wt. 127 lbs. Temperature normal. Slight cough and expectoration. T. b.'s present. General health good. Lives West. After discharge, four months, had severe hemorrhagic period, but nine months later in fair health. Temperament favored cure. Finances adequate. At time of discharge cavity was a little smaller and there were signs of slight increase of density over the remainder of the lung. No rales.

CASE 95. Male, age 28; ranchman. Tuberculous history ten years. Six years ranch life in the West. In early history had been in Saranac for health. General condition constantly excellent. Wt. 155 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. Under treatment six months. Slight infiltration both apices, dry on right side and a few rales on left. Result: Wt. 166 lbs. Temperature normal. General health excellent. Cough and expectoration slight. One year later in about the same condition lives West. Temperament rather unfavorable to cure. Finances adequate. Had been ill-advised for years. Rales disappeared, but otherwise pulmonary status the same.

CASE 96. Male, age 20; clerk. Tuberculous history six months, following influenza. Wt. 116 lbs. Average daily maximum temperature 99.4° F. Cough and expectoration slight. T. b.'s present. Under treatment one year. Consolidation right apex to second rib, with small cavity. Very slight infiltration left apex. Rales on right side. Result: Wt. 132 lbs. Temperature normal. General health very good. Cough and expectoration slight. T. b.'s present. Temperament very unfavorable to cure. Finances adequate. Went to Colorado and is now working. Cavity healed, otherwise pulmonary condition unchanged.

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CASE 97. Male, age 31; clerk. Tuberculous history three years, following pneumonia. Had been living faultv ranch life for past two years. General health impaired past six months. Wt. 128 lbs. Temperature normal. Very short of breath. Marked cough and expectoration. T. b.'s present. Under treatment a few days. Consolidation right upper lobe with cavity. Infiltration remainder of right lung, and left upper lobe down to third rib. Rales very numerous over lesion. Sent home. Learned that that he was slowly failing some months later. Temperament unknown. Finances inadequate.

CASE 98. Male, age 20; window-trimmer. Tuberculous history two months, following pneumonia eight months before. Average daily maximum temperature 99.8° F. Moderate cough and expectoration. T. b.'s present. Under treatment one year. General infiltration right lung and left apex. Rales all over lesion. Patch consolidation with large cavity upper right lung posterior. Wt. 129 lbs. Pulse 140. Result: Wt. 144 lbs. Temperature normal. Very slight cough and expectoration. T. b.'s present. General health very good. Temperament favored cure. Supported by institution. With the exception of occasional fever attacks has maintained condition since discharge one year ago. Does light work. Signs of infiltration both apices, and slight increase of density over right lung. Cavity and surrounding consolidation unchanged. No rales. Six months later was brought in from ranch where he was working and died in three hours.

CASE 99. Male, age 28; physician. Tuberculosis followed acute rheumatism eight months previously. Very slight expectoration. No cough. T. b.'s absent. Had been five months in the West taking good care of himself. Had t. b.'s when he left home. Temperature normal. Under treatment one month. Wt. 135 lbs. Exceedingly slight signs of increased density over right apex. Case carefully studied to confirm absence of t. b.'s and advised to go to work. Has been at work two years in the West and health has remained good.

CASE 100. Female, age 31; housewife. Pregnant five months. Temperature normal. Slight cough and expectoration. T. b.'s present. Wt. 105 lbs. Infiltration of the larynx. Tuberculosis apparently began with pregnancy. Under treatment two months. Slight infiltration over apices, and impaired breathing over lower left lobe. Result: Wt. 117 lbs. Temperature normal. Larynx and pulmonary condition unchanged. Slight cough and expectoration. T. b.'s present. Sent home for approaching confinement. Failed rapidly after birth of child, and died in three months. Temperament favorable to cure. Finances adequate.

CASE 101. Male, age 27; bookkeeper. Tuberculous history four months. Went at once to Arizona and led a very faulty life until he entered institution. Average daily maximum temperature 101½° F. Wt. 110 lbs. Marked cough and expectoration. T. b.'s present. Under treatment one month. Cavity right apex. Consolidation remainder of right upper lobe. Infiltration remainder of right lung anterior. Infiltration left lung to fourth rib. Consolidation of upper two thirds of right lung posterior and immense cavity, scap. region. Rales all over lesion. Result: Advised to return home, where he died three weeks later. Temperament unknown. Finances adequate.

CASE 102. Male, age 31; salesman; asthmatic; hay fever. Tuberculous history several years. Had been in New Mexico one year before entering the institution. Chronic mucus gastritis, with dilation. Temperature normal. Marked cough and expectoration. T. b.'s present. Under treatment one year. Consolidation left apex to second rib. Infiltration right apex anterior, consolidation,

posterior with small cavity. No rales. Wt. 134 lbs. Result: Wt. 150 lbs. Temperature normal. Cough and expectoration much diminished. T. b.'s present. General health good. Left the institution contrary to advice and has about maintained the status quo during the past year, leading the life of a peripatetic invalid. Temperament rather unfavorable to cure. Finances adequate. Cavity healed; otherwise not much change in pulmonary status.

CASE 103. Male, age 21; student. Tuberculous history a few months. Slight cough and expectoration. T. b.'s present. Temperature normal. Admitted during a hemorrhage. Under treatment three months. Wt. 159 lbs. Slight infiltration right apex. Result: No cough and very slight expectoration. T. b.'s absent. Wt. 177 lbs. General health excellent. Temperature normal. Temperament unfavorable to cure. Finances inadequate. Has led the life of a cow-boy for the past year and a half and health has been fine. Signs of slight increase of density over right apex.

CASE 104. Male, age 23; chemist. Tuberculous history three months. Average daily maximum temperature 99.2° F. Slight cough and expectoration. T. b.'s present. Wt. 145 lbs. Under treatment four months. Slight infiltration with rales, right apex to second rib. Result: Wt. 185 lbs. No cough or expectoration. Temperature normal. General health excellent. Temperament favored cure. Finances adequate. Returned east to his home and work and has remained well since, one and a half years. Practically no pulmonary signs.

CASE 105. Female, age 29; dressmaker. Tuberculous history four months. Temperature normal. Slight expectoration. Marked cough. Wt. 111 lbs. T. b.'s present. Under treatment six months. Slight infiltration without rales right apex. Result: Wt. 138 lbs. Temperature normal. No cough or expectoration. General health excellent. Temperament favored cure. Finances inadequate; partly supported by institution. Pulmonary signs practically absent. Lives West and works at trade. Health remains good, one year.

CASE 106. Male, age 55; merchant. Wt. 152 lbs. Temperature normal. Marked cough and expectoration. T. b.'s present. Under treatment six months. Tuberculosis succeeded chronic bronchitis of many years standing. Slight infiltration to the fourth rib left upper lobe with rales. Result: Wt. 178 lbs. Temperature normal. Cough and expectoration slightly diminished. Pulmonary signs unchanged. T. b.'s present. Temperament unfavorable to cure. Finances adequate. Went to El Paso and lives there. Has fairly good health.

CASE 107. Male, age 24; clerk. History of awful sexual excess. Cared for consumptive brother. Tuberculous history six months. Severe hemorrhage. Wt. 110 pounds. Temperature normal. Slight cough and expectoration. T. b.'s present. Under treatment three months. Very slight dry infiltration both apices. Result: Cough and expectoration absent. Temperature normal. Wt. 123 lbs. Signs of slight increase of density over apices. Temperament favorable to cure. Finances adequate. Subsequent history unknown.

CASE 108. Male, age 21; student. Exposed to tuberculosis in hospital work. Tuberculous history six months. Wt. 116 lbs. Slight cough and expectoration. T. b.'s present. Temperature normal. During treatment had pleuritic effusion left side and was twice tapped. Under treatment eight months. Consolidation left apex to third rib. Infiltration remainder of left upper lobe, with rales all over. Slight dry infiltration right apex. Result: Wt. 145 lbs. Temperature normal. No cough. Very slight expectoration. T. b.'s absent. Temperament

fairly cooperative. Finances adequate. Returned home and to college and has remained well one year. Slight increase of density over apices.

CASE 109. Male, age 32; clerk. Tuberculous history five months. Slight cough and expectoration. Had several slight hemorrhages during treatment. T. b.'s present. Wt. 135 lbs. Temperature normal. Under treatment six months. Slight infiltration right upper lobe. Few rales. Result: Wt. 176 lbs. No cough or expectoration. Temperature normal. Practical absence of physical signs. Returned home and has remained well past year. Temperament favored cure. Finances adequate.

CASE 110. Male, age 22; clergyman. Average daily maximum temperature 102° F. Marked cough and expectoration. T. b.'s present. Wt. 126 lbs. Tuberculous history five months. Recent operation for empyema. Under treatment six months. Consolidation with great destruction of upper lobes of entire right lung. Rales universal. Slight dry infiltration left apex. Result: Failed constantly. Developed laryngeal tuberculosis. Sent home and died in a few months. Temperament favored cure. Supported by institution. No special pulmonary change.

CASE 111. Male, age 30; clerk. Tuberculous history six months. Wt. 129 lbs. Average daily maximum temperature 100° F. Marked cough and expectoration. T. b.'s present. Infiltration of the larynx. Voice impaired. Under treatment one year. Consolidation of the left apex, with infiltration of the remainder of the left upper lobe. Rales all over this lobe. Dry infiltration of right upper lobe. Result: At first did very well. Gained ten pounds in weight. Average daily maximum temperature came below 100° F. with the exception of occasional exacerbation. As time went on fever attacks were separated by longer intervals. Went back to the same weight as on admission. Laryngeal lesion remained stationary. Concluded to try a change and went to Colorado Springs and a few months later was reported as doing better. Consolidation in left upper lobe extended.

CASE 112. Male, age 52; merchant. Tuberculous history four years. Failure apparently dated from successful tuberculin test in the Adirondacks. Average daily maximum temperature 101° F. Marked cough and expectoration. T. b.'s present. Wt. 125 lbs. Under treatment three months. Ulceration of larynx. Dry consolidation of right apex, and infiltration remainder of right upper lobe. Infiltration right middle and lower lobes with numerous rales. Infiltration with rales, left apex. Result: Wt. 122 lbs. Larynx slightly improved, and all soreness removed. Lesion extended a little in the left lung; otherwise pulmonary condition about the same. Average daily maximum temperature 99.6° F. Very weak. Cough and expectoration unchanged. T. b.'s present. Advised to return home where he died a year later. Temperament unfavorable to cure. Finances adequate.

CASE 113. Male, age 44; engraver. Alcoholic. Syphilitic. Tuberculosis dated from hemorrhage four months before. Slight cough and expectoration. T. b.'s present. Wt. 181 lbs. Under treatment four months. Temperature normal. Slight infiltration, with rales, right apex. Patch of infiltration, with rale, left base posterior. Result: Wt. 191 lbs. Temperature normal. Slight cough and expectoration. T. b.'s absent. Practical absence of pulmonary signs. Returned home and to work and has remained well one year. Temperament favored cure. Finances adequate.

CASE 114. Female, age 36; dressmaker. Tuberculous history eight months. Average daily maximum temperature 99.2° F. Infiltration of larynx with impaired voice. Moderate cough and expectoration. T. b.'s present. Wt. 125 lbs. Under treatment eight months. Had gained fifteen pounds under eastern specialist. General slight infiltration of the right lung, with rales. Result: No cough. Very slight expectoration. T. b.'s absent. Wt. 151 lbs. Temperature normal. Larynx normal. Temperament favored cure. Finances inadequate. Partly supported by institution. Lives West, works and has maintained health one year. Slight signs of increased density over left apex.

CASE 115. Male, age 17; student. Tuberculous history one year, following measles. Pulmonary signs very slight and indefinite. Cough and expectoration very slight. T. b.'s absent. Temperature normal. Wt. 140 lbs. Under treatment four months. Result: Wt. 154 lbs. No cough, expectoration or pulmonary signs. Temperature normal. Temperament favored cure. Finances adequate.

CASE 116. Male, age 25; insurance clerk. Tuberculous history three months. Wt. 105 lbs. Average daily maximum temperature 99° F. Moderate cough and expectoration. T. b.'s present. Under treatment five months. Consolidation of most of the right upper lobe. Infiltration left apex to first rib. Rales over lesion. Result: Wt. 122 lbs. Temperature normal. No cough and very slight expectoration. T. b.'s absent. Temperament favored cure. Finances adequate. Lives West. Works and is well; one year. Signs of slight increase of density over apices.

CASE 117. Male, age 21; student. Marked febrile history for three months. Tuberculous glands in neck for nine months. Wt. 161 lbs. Very indefinite pulmonary signs. Enlarged bronchial glands. Average daily maximum temperature 104° F. Never normal at any time. Failed constantly and was sent home in six weeks and died two weeks later. Sputum negative. Post-mortem showed miliary tuberculosis.

CASE 118. Male, age 22; student. Tuberculous history one and a half years, during most of which time he had been in an institution in the Adirondacks. Cough and expectoration moderate. T. b.'s present. Average daily maximum temperature 99.4° F. Wt. 150 lbs. Under treatment nine months. Dry infiltration right apex to bottom of first rib. Infiltration of the left upper lobe, with consolidation of lower third, and small effusion on this side. Rales all over left side. Result: Wt. 188 lbs. Temperature normal. No cough and very slight expectoration. T. b.'s absent. General health very good. Excellent patient. Finances adequate. Has maintained his health. Lives West. Signs of more or less increase of density over left upper lobe, and still a consolidated patch at the bottom of this lobe anterior. Also slight increase of density over right apex. No rales.

CASE 119. Female, age 33; no occupation. Chronic abscess left ear. Tuberculous history two years. Temperature normal. Wt. 100 lbs. Much cough and moderate expectoration. T. b.'s present. Under treatment six months. Slight infiltration, dry, of the right apex, and active infiltration of the left apex. Result: Wt. 112 lbs. Last month had slight daily rise of temperature, but sputum was negative. Cough and expectoration very slight. Temperament very unfavorable to cure. Finances adequate. Right apex clear. Left apex signs of slight increase of density.

CASE 120. Male, age 28; clerk. Tuberculous history twenty months. Infiltration of larynx. Voice much impaired. Marked cough and expectoration.

T. b.'s present. Had been under treatment at Asheville, N. C., for some time. Wt. 135 lbs. Average daily maximum temperature 99.6° F. Under treatment three months. Active infiltration upper left lobe apex to fifth rib. Dry infiltration and small cavity right apex. Result: Wt. 149 lbs. Temperature normal. Larynx and voice improved. T. b.'s present. Cough and expectoration diminished. Temperament unfavorable to cure. Finances inadequate. Went East contrary to advice and apparently has maintained improvement. Except that rales were fewer, no change in pulmonary signs.

CASE 121. Male, age 45; publisher. Alcoholic. Tuberculous history three months, dating from a hemorrhage. Very poor digestion. Wt. 141 lbs. Moderate cough and expectoration. Average daily maximum temperature 99.6° F. T. b.'s present. Under treatment eight months. Had a great deal of trouble with diarrhoea during treatment. Active infiltration of both apices. Result: Wt. 141 lbs. Temperature normal. Very slight cough and expectoration. T. b.'s present. Good general condition. Temperament unfavorable to cure. Finances adequate. Slight dry infiltration both apices.

CASE 122. Male, age 21; jeweler. Sexual dissipation. Tuberculous history three months, beginning with hemorrhage. Wt. 129 lbs. Average daily maximum temperature 100° F. Much cough and slight expectoration. Under treatment eleven months. T. b.'s present. Marked infiltration of the left apex, and slight infiltration, scattered, of the remainder of the left lung anterior. Slight dry infiltration of the right apex. Numerous rales on left side. Result: At first improved rapidly. Temperature came to normal. Wt. increased to 138 lbs. Pulmonary condition improved rapidly. Following rank imprudence and overexertion had a series of hemorrhages, and high fever. Never regained what he lost at this time. After hemorrhages average daily maximum temperature was 99.4° F. Wt. fell to 139 lbs., where it remained. Cough and expectoration continued unchanged. T. b.'s present. Temperament very unfavorable to cure, and finally went home as a result of exhausted finances. Slight infiltration left upper lobe to fourth rib, with a few rales. Dry infiltration right apex.

CASE 123. Male, age 25; lawyer. Tuberculous history three months. Average daily maximum temperature 99.6° F. Slight cough and expectoration. T. b.'s present. Under treatment one year. Wt. 129 lbs. Consolidation with small cavity and few rales right apex. Very slight dry infiltration left apex. Result: Wt. 150 lbs. Temperature normal. Cough and expectoration slight. T. b.'s present. General condition good. Temperament unfavorable to cure. Finances adequate. Lives West. Marked dry infiltration of right apex.

CASE 124. Male, age 36; merchant. Slight cough and expectoration. T. b.'s present. Tuberculous history six months. Temperature normal. Under treatment eight months. Slight infiltration of the larynx. Wt. 147 lbs. Slight active infiltration of both apices. Result: Wt. 178 lbs. Temperature normal. No cough or expectoration. General health good. Larynx normal. Practical absence of pulmonary signs. Finances adequate. Temperament favored cure. Lives West and has remained well. Larynx normal.

CASE 125. Male, age 21; student. Tuberculous history a few weeks. Moderate cough and expectoration. T. b.'s present. Average daily maximum temperature 105° F. Too ill to weigh. Rales all over, but pulmonary condition not carefully studied. Developed general cutaneous emphysema and died seven days after admission.

CASE 126. Male, age 38; brakeman. Tuberculous history five months. Moderate cough and expectoration. T. b.'s present. Wt. 160 lbs. Slight laryngeal infiltration. Average daily maximum temperature 100° F. Under treatment two months. Night sweats. Slight infiltration of both apices with rales on the right side. Result: Wt. 160 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration unchanged. T. b.'s present. Temperament unfavorable to cure. Larynx unchanged. Went home on his own account. Subsequent history unknown. Finances adequate. Practically no change in pulmonary condition.

CASE 127. Male, age 62; banker and farmer. Tuberculous history twenty years. Wt. 155 lbs. Average daily maximum temperature 99° F. Marked cough and expectoration. T. b.'s present. Under treatment three months. Large cavity right apex. Consolidation right upper lobe. Scattered infiltration remainder of right lung, and dry infiltration left apex. Rales all over right side. Result: Pulmonary status about the same. Wt. 157 lbs. Average daily maximum temperature 99.2 to 99.4° F. Cough and expectoration the same. T. b.'s present. Temperament favored cure. Finances adequate. Returned home and died of some intercurrent disease six months later.

CASE 128. Male, age 21; student. Tuberculous history eleven months. Died thirty-six hours after admission. Should not have been permitted to leave home. Not examined.

CASE 129. Male, age 38; salesman. Tuberculous history five years. Moderate cough and expectoration. T. b.'s present. Temperature normal. Under treatment three months. Wt. 105 lbs. Peripatetic invalid for a long time. Cavity and consolidation right apex; few rales. Consolidation left apex to third rib. Infiltration remainder of left lung. Rales all over this side. Result: Wt. 108 lbs. Temperature normal. Cough and expectoration much diminished. T. b.'s present. Temperament very unfavorable to cure. Finances adequate. Could not tolerate sanatorium life. Practically no change in pulmonary condition.

CASE 130. Male, age 34; merchant. Tuberculous history two years. Very advanced and feeble. Not examined. Was at once sent home, where he died shortly after arrival.

CASE 131. Male, age 50; bank-clerk. Bronchitis for many years. Tuberculous symptoms about five months. Marked cough and expectoration. T. b.'s present. Wt. 162 lbs. Average daily maximum temperature 100° F. Under treatment eight months. Very slight infiltration both apices. No rales. Result: Wt. 178 lbs. Temperature usually normal, occasional slight rise. Cough and expectoration diminished. T. b.'s present. Temperament unfavorable to cure. Finances adequate. Signs of very slight increase of density over both apices.

CASE 132. Male, age 41; merchant. Tuberculous history four years. Many hemorrhages. Marked cough and expectoration. T. b.'s present. Wt. 127 lbs. lbs. Much diarrhoea during past six months. Voice impaired. Infiltration of larynx. Emphysema with great shortness of breath. Average daily maximum temperature 99.8° F. Chronic abscess both ears. Under treatment seven months. Consolidation left apex to second rib, with infiltration remainder of left lung. Rales all over this side. Active infiltration right apex. Result: Wt. 141 lbs. Average daily maximum temperature 99.6° F. Cough and expectoration diminished. Larynx and voice improved. T. b.'s present. On account of increasing shortness of breath was sent to institution in lower altitude, where he has continued to improve. Temperament favored cure. Finances adequate. Never any special change in pulmonary condition; possibly fewer rales.

CLINICAL SECTION

CASE 133. Male, age 29; clerk. Tuberculous history nine months. Average daily maximum temperature 99° F. Very slight cough and expectoration. T. b.'s present. Under treatment nine months. Wt. 124 lbs. Very slight infiltration right apex, and middle lobe posterior. Result: Wt. 144 lbs. Temperature normal. Cough and expectoration absent. T. b.'s absent. Temperament favored cure. Lives West. Finances adequate. No pulmonary signs.

CASE 134. Male, age 21; student. Tuberculous history four months. Wt. 122 lbs. Average daily maximum temperature 103° F. Not normal at any time in the twenty-four hours. Severe night sweats. Marked cough and expectoration. T. b.'s present. Under treatment six months. Very large cavity, and consolidation right upper lobe. Few rales. Result: Wt. 156 lbs. Temperature normal. Cough and expectoration much diminished. T. b.'s present. Temperament favored cure. Finances adequate. Cavity much diminished in size, and consolidation cleared. No rales.

CASE 135. Male, age 27; physician. Tuberculous history six years. Wt. 108 lbs. Average daily maximum temperature 101° F. Marked cough and expectoration. T. b.'s present. Ulceration of larynx, including epiglottis. Very painful. Total absence of voice and cords. General health very much impaired. Consolidation right upper lobe with large cavity. Infiltration middle lobe, and scattered active infiltration right lower lobe in front. Consolidation left upper lobe to fourth rib. Active infiltration left lower lobe posterior. Result: Wt. 136 lbs. Average daily maximum temperature 99° F. All laryngeal ulceration healed. Larynx still infiltrated. No pain or soreness. No voice. Cough and expectoration much diminished. T. b.'s present. Excellent patient. Had to stop treatment on account of finances. Right lung pretty much cleared except cavity and small area of consolidation surrounding it. Slight increase of density over left apex. Small patch of active infiltration lower left lobe.

CASE 136. Male, age 34; salesman. Tuberculous history one year. Average daily maximum temperature 99.6° F., with occasional fever attacks. Marked cough and expectoration. T. b.'s present. Under treatment six months. Wt. 110 lbs. Active consolidation right upper lobe, and remainder of right lung infiltrated, with rales. Dry infiltration left apex. Small cavity right upper lobe posterior. Result: Wt. 133 lbs. Average daily maximum temperature 99.4° F. Cough and expectoration slightly less. T. b.'s present. Temperament favored cure. Left institution on account of inadequate finances. Subsequent history unknown. Rales very much less, and otherwise not much change in pulmonary conditon.

CASE 137. Male, age 50; merchant. Tuberculous history many years. Had a fearful diarrhoea at time of admission, and appeared to be a very advanced case. Not examined. Died in a few days. Probably killed by trip. Should not have been sent away from home.

CASE 138. Male, age 34; farmer. Tuberculous history two months. Slight impairment of voice and infiltration of larynx. Moderate cough and expectoration. T. b.'s present. Wt. 147 lbs. Temperature usually normal, with occasional slight fever attacks. Under treatment six months. Slight dry infiltration both apices. Result: Wt. 165 lbs. Temperature usually normal. Voice and larynx about the same. Cough and expectoration the same. T. b.'s present. Temperament favored cure. Forced to go home for business reasons. Pulmonary condition practically unchanged.

CASE 139. Male, age 40; contractor. Alcoholic. Wt. 123 lbs. Average daily maximum temperature 102° F. Marked cough and expectoration. T. b.'s present. Ulceration of soft palate, fauces, tonsils, pharynx, epiglottis and larynx. Very great pain and suffering. Under treatment a few days. Extensive disease of both lungs, with cavities. At once sent home where he died shortly.

CASE 140. Male, age 25; bank-clerk. Tuberculous history three years. Had been to a number of institutions and places. Peripatetic. Alcoholic. Wt. 136 lbs. Temperature normal. Moderate cough and expectoration. T. b.'s present. Chronic mucus gastritis. Under treatment five months. Dry infiltration right upper lobe. Small cavity posterior. Result: Conditions all unchanged at the time of discharge. Finances adequate.

CASE 141. Male, age 21; bank-clerk. Tuberculous history three years. Very slight cough and expectoration. T. b.'s present. Wt. 125 lbs. Temperature normal. Under treatment nine months. Slight infiltration both apices, with rales. Result: Wt. 145 lbs. Temperature normal. No cough. Very slight expectoration. T. b.'s absent. General condition excellent. Temperament unfavorable to cure. Finances adequate. Practical absence of pulmonary signs.

CASE 142. Male, age 32; book-keeper. Tuberculous history nine months. Temperature normal. Wt. 127 lbs. Moderate cough and expectoration. T. b.'s present. Under treatment seven months. Consolidation right apex; infiltration remainder of right upper lobe and left apex. Very few rales on right side. Result: Wt. 149 lbs. Temperature normal. No cough and very slight expectoration. T. b.'s absent. Temperament favored cure. Finances inadequate. Signs of slight increase of density over right apex.

CASE 143. Male, age 20; student. Tuberculous history five months. Slight cough and expectoration. T. b.'s present. Wt. 135 lbs. Average daily maximum temperature 99.2° F. Under treatment eight months. Slight infiltration right apex with a few rales. Very slight infiltration left apex; dry. Result: Wt. 147 lbs. Temperature normal. No cough. Very slight expectoration. T. b.'s absent. Temperament favored cure. Finances adequate. Signs of slight increase of density over right apex.

CASE 144. Male, age 35; manufacturer. Tuberculous history six years. Wt. 105 lbs. Temperature usually normal. Occasional fever attacks. Marked cough and expectoration. T. b.'s present. Under treatment three months. Very feeble. Short of breath on slight exertion. Consolidation of right upper lobe. Scattered infiltration of right lower and middle lobes anterior. Few rales. Consolidation of the upper half of the left upper lobe, with immense cavity. Scattered infiltration of remainder of left upper lobe, with a few rales. Practically no change in condition. Sent home. Temperament favored cure. Finances adequate.

CASE 145. Male, age 23; bank-clerk. Tuberculous history about three months. Very slight cough and expectoration. T. b.'s present. Average daily maximum temperature 100° F. Wt. 123 lbs. Under treatment six months. Slight infiltration of both apices with a few rales. Result: Wt. 147 lbs. Temperature normal. No cough and practically no expectoration. T. b.'s absent. Temperament favorable to cure. Finances adequate. Signs of very slight increase of density over right apex.

CASE 146. Female, age 26; clerk. Tuberculous history three years. Wt. 100 lbs. Temperature normal, with occasional slight rise during menstruation.

Marked cough and expectoration. T. b.'s present. Under treatment ten months. Consolidation left apex with cavity. Infiltration of right apex. No rales. Result: Wt. 116 lbs. Temperature normal except during menstruation. Cough and expectoration diminished. T. b.'s present. Temperament somewhat unfavorable to cure. Finances adequate. No special change in pulmonary status.

CASE 147. Male, age 23; merchant. Tuberculous history two months. Wt. 140 lbs. Average daily maximum temperature 101° F. Never reached normal at any time. Night sweats. Marked cough and expectoration. T. b.'s present. Under treatment nine months. Consolidation right apex; two small cavities posterior; infiltration remainder of right upper lobe, and scattered infiltration right lower lobe. Suspicious signs left apex. Rales over lesion on right side. Result: Wt. 166 lbs. Temperature normal. Cough and expectoration very slight. T. b.'s present. Temperament favored cure. Finances adequate. Signs of slight increase of density over right upper lobe anterior, and the same posterior with the exception of one small cavity. No rales.

CASE 148. Male, age 23; student. Tuberculous history three months. Slight cough and expectoration. T. b.'s present. Temperature normal. Wt. 140 lbs. Under treatment seven months. Dry consolidation right apex. Result: Wt. 167 lbs. Temperature normal. Very good health. No cough or expectoration. Signs of slight increase of density over the right apex. Temperament favored cure. Finances adequate.

Classification according to the scheme authorized by the National Society for the Study and Prevention of Tuberculosis. In addition cases in which hemorrhage occurred are tabulated, and those in which temperament or financial condition were unfavorable. Six cases are omitted from the tabulation because the diagnosis of tuberculosis was not clear or was unconfirmed. Thirty-one cases are omitted because the patients were under treatment one month or less than one month. Reference from the number in the tabulation to the same number among the case histories will furnish the original case. An understanding of Turban's scheme of classes 1, 2 and 3 is necessary to comprehension of the classification. The observations cover a period of seven years.

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
1	Adm.	Incip.	I.	6 w.	Fav.	100°	+	o	o	+	o	42
	Dis.	Ap. cure	H. les.	2 y. 6 w.	Excel.	N	o	o	o			
2	Adm.	Incip.	I.	4 mo.	Unfav.	100	+	o	Malaria.	o	o	63
	Dis.	Ap. cure	H. les.	2 y. 4 m.	Excel.	N	o		o			
3	Adm.	Mod. ad.	I.	2 y.	Fav.	N	+	o	o	o	o	33
	Dis.	Arrested	I.	3 y. 8 m.	Good.	N	+	o	o			
4	Adm.	Far ad.	III.	15 mo.	Unfav.	102.5	+	Testicle, ribs, kidney, ureter	o	o	o	36
	Dis.	Ap. cure	H. les.	2 y. 3 m.	Good.	N	o	o	o			
5	Adm.	Far ad.	III.	6 mo.	Unfav.	103+	+	o	o	+	o	60
	Dis.	Arrested	III.	2 y. 6 m.	Good.	N	+	o	o			
6	Adm.	Incip.	I.	6 mo.	Fav.	99.6	+	o	o	o	o	23
	Dis.	Arrested	I.	2 y.	Good.	N	+	o	o			
7	Adm.	Far ad.	III.	6 mo.	Fav.	99.4	+	o	o	o	+	26
	Dis.	Imp.	III.	4 mo.	Good.	N	+	o	o			
9	Adm.	Mod. ad.	II.	6 y.	Fav.	N	+	o	o	o	+	12
	Dis.	Imp.	I.	6 y. 3 m.	Good.	N	o	o	o			
10	Adm.	Far ad.	III.	1 y.	Unfav.	101	+	o	Br. dis.	+	+	26
	Dis.	Died.	II.	3 y.	o	102	+	Larynx.	Br. dis.			
11	Adm.	Mod. ad.	II.	2 y.	Fav.	N	+	o	o	o	+	8½
	Dis.	Imp.	II.	2 y. 2 m.	Fav.	N	o	o	o			
12	Adm.	Mod. ad.	I.	10 m.	Fav.	N	+	Larynx.	o		+	12
	Dis.	Imp.	I.	13 m.	Fav.	N	+	Larynx.	o	o		
13	Adm.	Far ad.	III.	3 y.	Fav.	99.6	+	o	Gout.	o	+	o
	Dis.	Prog.	III.	3 y. 6 m.	Fav.	99.6	+	o	Gout.	o		
16	Adm.	Far ad.	III.	1 y.	Unfav.	100	+	o	o	o	o	o
	Dis.	Died.	III.	1½ y.	o	101	+	Emphy.	o			
17	Adm.	Far ad.	III.	6 m.	Fav.	99.4	+	o	o	+	+	o
	Dis.	Prog.	III.	1 y. 3 m.	Unfav.	103	+	o	o			
18	Adm.	Far ad.	III.	10 y.	Unfav.	99.6	+	o	Fun. mus. emphy.	o	o	o
	Dis.	Prog.	III.	11 y.	Unfav	99.6	+	Tes. bip.	Fun. mus. emphys.			
19	Adm.	Farad.	III.	9 y.	Unfav	99.6	+	o	o	o	+	o
	Dis.	Prog.	III.	10 y.	Unfav.	99.6	+	o	o			

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
20	Adm.	Incip.	I.	4 m.	Fav.	N°	o	o	o	o	+	17
	Dis.	Arrested	I.	6 m.	Excel.	N	o	o	o			
22	Adm.	Far ad.	III.	7 m.	Unfav.	99.6	+	o	at. phar.	o	+	o
	Dis.	Prog.	III.	1 y. 7 m.	Unfav.	101	+	o	"			
24	Adm.	Incip.	I.	2 y.	Fav.	N	+	o	o	o	+	32
	Dis.	Ap. cure.	H. les.	2 y. 2 m.	Excel.	N	o	o	o			
25	Adm.	Far ad.	III.	5 y.	Unfav.	100	+	o	o	o	+	o
	Dis.	Prog.	III.	5 y. 2 m.	Unfav.	100	+	o	o			
26	Adm.	Arrested	III.	2½ y.	Fav.	N	+	o	o	o	o	3½
	Dis.	Arrested	III.	2 y. 10 m.	Fav.	N	+	o	o			
28	Adm.	Far ad.	III.	6 m.	Unfav.	102½	+	o	o	+	+	o
	Dis.	Died.	III.	11 m.	o	103	+	o	o			
31	Adm.	Far ad.	III.	2 y.	Unfav.	N	+	o	o	+	+	20
	Dis.	M'chlm.	III.	5½ y.	Fav.	N	+	o	o			
34	Adm.	Far ad.	III.	1 y. 2 m.	Unfav.	N	+	o	o	o	+	24
	Dis.	Arrested	III.	1 y. 8 m.	Fav.	N	+	o	o			
36	Adm.	Far ad.	III.	1 y.	Unfav.	102	+	Lar. epi.	o	o	+	o
	Dis.	Prog.	III.	1 y. 6 m.	Unfav.	102	+	"	o			
37	Adm.	Far ad.	III.	1 y. 3 m.	Unfav.	103	+	o	o	o	+	o
	Dis.	Prog.	III.	1 y. 5 m.	Unfav.	103	+	o	o			
39	Adm.	Far ad.	III.	6 m.	Unfav.	N	+	o	o	o	+	34
	Dis.	Arrest.	III.	1 y. 3 m.	Fav.	N	+	o	o			
40	Adm.	Mod. ad.	II.	9 y.	Unfav.	N	+	o	Tachy.	+	o	10
	Dis.	Prog.	II.	9 y. 6 m.	Unfav.	N	+	o	"			
42	Adm.	Far ad.	III.	4 m.	Unfav.	99.6	+	o	o	o	+	o
	Dis.	Prog.	III.	12 m.	Unfav.	99.6	+	o	o			
43	Adm.	Far ad.	III.	3 y.	Fav.	N	+	o	o	o	+	47
	Dis.	Arrested	III.	3 y. 9 m.	Fav.	N	+	o	o			
44	Adm.	Arrested	I.	2 y.	Fav.	N	o	o	o	o	+	12
	Dis.	Arrested	I.	2 y. 5 m.	Fav.	N	o	o	o			
45	Adm.	Far ad.	III.	2 y.	Fav.	N	+	Pl. effu.	o	o	o	29
	Dis.	Arrested	III.	3 y. 2 m.	Fav.	N	+	o	o			
46	Adm.	Incip.	I.	6 m.	Fav.	N	+	o	o	+	o	50
	Dis.	Ap. cure.	H. les.	1½ y.	Excel.	N	o	o	o			
49	Adm.	Far ad.	III.	4 y.	Fav.	99.6	+	Larynx.	o	o	+	o
	Dis.	Prog.	III.	4½ y.	Unfav.	100	+	"	o			

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable	Gain in Weight. Pounds.
								Tub.	Non-tub.			
50	Adm.	Far ad.	III.	6 y.	Fav.	99.6°	+	Larynx.	0	+	+	0
	Dis.	Prog.	III.	6 y. 5 m.	Unfav.	99.6	+	"	0			
51	Adm.	Far ad.	III.	1 y.	Unfav.	102	+	0	0	+	+	10
	Dis.	Imp.	III.	1 y. 7 m.	Fav.	99.6	+	0	0			
53	Adm.	Far ad.	III.	1½ y.	Unfav.	N	+	0	0	0	0	0
	Dis.	Prog.	III.	1 y. 11 m.	Unfav.	99.6	+	0	0			
54	Adm.	Far ad.	III.	2 y.	Fav.	99.4	+	Larynx.	0	0	0	0
	Dis.	Prog.	III.	2 y. 7 m.	Unfav.	102	+	Larynx epiglot.	0			
55	Adm.	Far ad.	III.	3 y.	Unfav.	100	+	Intestine fistula larynx.	0	0	0	0
	Dis.	Prog.	III.	3 y. 5 m.	Unfav.	100	+	Intestine pneumothorax.	0			
56	Adm.	Far ad.	III.	8 y.	Unfav.	99.6	+	Intestine	0	0	0	0
	Dis.	Prog.	III.	8 y. 2 m.	Unfav.	100	+	"	0			
57	Adm.	Far ad.	III.	6 m.	Fav.	N	+	Larynx.	0	+	+	2½
	Dis.	Prog.	III.	1 y. 2 m.	Fav.	99	+	"	0			
58	Adm.	Mod. ad.	II.	4 m.	Unfav.	N	+	0	0	0	+	4
	Dis.	Imp.	II.	6 m.	Unfav.	N	+	0	0			
59	Adm.	Mod. ad.	II.	1 y.	Unfav.	99.6	+	0	Mit. mus.	0	+	17
	Dis.	Imp.	II.	1 y. 5 m.	Unfav.	N	+	Fis. ano.	"			
61	Adm.	Mod. ad.	II.	7 m.	Fav.	99.6	+	0	0	0	0	78
	Dis.	Ap. cure	H. les.	1 y. 7 m.	Excel.	N	0	0	0			
62	Adm.	Incip.	I.	1 y.	Fav.	N	+	0	0	0	+	8
	Dis.	Arrested	I.	1 y. 5 m.	Excel.	N	+	0	0			
63	Adm.	Mod. ad.	II.	12 y.	Fav.	100	+	0	Emphy.	+	0	23
	Dis.	Imp.	II.	14½ y.	Fav.	N	+	0	"			
67	Adm.	Far ad.	III.	3 y.	Unfav.	100	+	Larynx.	0	0	0	35
	Dis.	Ap. cure	H. les.	5 y. 4 m.	Excel.	N	0	0	0			
69	Adm.	Mod. ad.	II.	2 y.	Unfav.	N	+	0	0	0	0	22
	Dis.	Ap. cure	H. les.	3 y.	Good	N	0	0	0			
70	Adm.	Far ad.	III.	1 y.	Unfav.	101+	+	Oti. med.	0	0	+	20
	Dis.	Imp.	III.	1 y. 4 m.	Fav.	99.4	+	Oti. med.	0			
71	Adm.	Far ad.	III.	1 y.	Fav.	100	+	Larynx.	0	0	+	22
	Dis.	Imp.	III.	1 y. 8 m.	Fav.	99.6	+	"	0			

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
73	Adm.	Mod. ad.	II.	3 m.	Fav.	100°	+	o	o	o	+	22
	Dis.	Imp.	III.	8 m.	Fav.	99.4	+	o	o			
74	Adm.	Incip.	I.	7 m.	Fav.	N	+	o	o	o	o	13
	Dis.	Ap. cure	H. les.	1 y.	Excel.	N	o	o	o			
75	Adm.	Mod. ad.	II.	3 y.	Unfav.	99.6	+	o	o	o	o	29
	Dis.	Arrested	I.	3 y. 9 m.	Excel.	N	+	o	o			
76	Adm.	Mod. ad.	I.	4 y.	Unfav.	100	+	o	o	+	o	o
	Dis.	Died.	III.	4 y. 4 m.	o	100	+	Br.pneu.	o			
77	Adm.	Far ad.	III.	1 y.	Fav.	99.2	+	Larynx.	Syph.	o	+	2
	Dis.	Imp.	III.	1 y. 4 m.	Fav.	N	+	o	Syph.			
79	Adm.	Incip.	I.	6 m.	Fav.	N	o	o	o		o	17
	Dis.	Ap. cure	H. les.	11 m.	Excel.	N	o	o	o			
80	Adm.	Incip.	I.	8 m.	Fav.	N	+	Rec. abs.	Anthr's.	o	o	34
	Dis.	Imp.	I.	1 y. 2 m.	Excel.	N	+	o	Anthr's.			
81	Adm.	Far ad.	III.	1 y.	Fav.	99.4	+	Larynx.	o	o	+	27
	Dis.	Arrested	III.	1½ y.	Excel.	N	+	o	o			
82	Adm.	Mod. ad.	II.	4 m.	Fav.	99.6	o	Appen's.	o	o	+	18
	Dis.	Imp.	II.	10 m.	Excel.	N	o	o	o			
85	Adm.	Far ad.	III.	1 y.	Fav.	99.4	+	Larynx.	Emphy.	+	o	8
	Dis.	Ap. cure	I.	1 y. 9 m.	Good.	N	o	o	Emphy.			
86	Adm.	Mod. ad.	I.	4 y.	Fav.	N	+	gls. neck	o	o	+	12
	Dis.	Arrested	I.	4 y. 3 m.	Good.	N	+	gls. neck	o			
88	Adm.	Incip.	I.	1 y.	Fav.	N	o	o	o		+	5
	Dis.	Ap. cure	H. les.	1 y. 2 m.	Excel.	N	o	o				
89	Adm.	Incip.	I.	3 m.	Fav.	N	+	o	o	o	o	4
	Dis.	Ap. cure	H. les.	9 m.	Excel.	N	o	o	o			
90	Adm.	Far ad.	III.	11 y.	Fav.	N	+	o	o	o	+	17
	Dis.	Imp.	III.	11 y. 3 m.	V.good	N	+	o	o			
94	Adm.	Far ad.	III.	3 y.	Unfav.	99.4	+	o	o	+	o	22
	Dis.	Arrested	III.	4 y.	Good.	N	+	o	o			
95	Adm.	Incip.	I.	10 y.	Fav.	N	+	o	o	o	+	11
	Dis.	Arrested	I.	10 y. 6 m.	Excel.	N	+	o	o			
96	Adm.	Mod. ad.	II.	6 m.	Unfav.	99.4	+	o	o	o	+	16
	Dis.	Imp.	II.	1½ y.	Fav.	N	+	o	o			
98	Adm.	Far ad.	III.	2 m.	Unfav.	99.8	+	o	o	o	+	18
	Dis.	Arrested	II.	1 y. 2 m.	Good.	N	+	o	o			

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B. 's.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
100	Adm.	Incip.	I.	5 m.	Unfav.	N	+	Larynx.	Fre. 5m.	o	o	12
	Dis.	Imp.	I.	7 m.	Unfav.	N	+	"	Fre. 7m.			
102	Adm.	Mod. ad.	II.	1 y.	Fav.	N	+	o	As. gas.	o	+	16
	Dis.	Arrested	II.	2 y.	Excel.	N	+	o	Asthma.			
103	Adm.	Incip.	I.	3 m.	Fav.	N	+	o	Syph.	+	+	18
	Dis.	Ap. cure.	H. les.	6 m.	Excel.	N	o	o	Syph.			
104	Adm.	Incip.	I.	3 m.	Fav.	99.2	+	o	o	o	o	40
	Dis.	Ap. cure.	H. les.	7 m.	Excel.	N	o	o	o			
105	Adm.	Incip.	I.	4 m.	Fav.	N	+	o	o	o	+	26
	Dis.	Ap. cure.	H. les.	10 m.	Excel.	N	o	o	o			
106	Adm.	Incip.	I.	?	Fav.	N	+	o	Ch. bron.	o	+	26
	Dis.	Arrested	I.	6 m.	Excel.	N	+	o	Ch. bron.			
107	Adm.	Incip.	I.	6 m.	Unfav.	N	+	o	o	o	o	13
	Dis.	Ap. cure.	H. les.	9 m.	Good.	N	o	o	o			
108	Adm.	Mod. ad.	II.	6 m.	Fav.	N	+	pl. effu.	o	o	o	29
	Dis.	Ap. cure.	H. les.	1 y. 2 m.	Excel.	N	o	o	o			
109	Adm.	Incip.	I.	5 m.	Fav.	N	+	o	o	+	o	41
	Dis.	Ap. cure.	H. les.	11 m.	Excel.	N	o	o	o			
110	Adm.	Far ad.	III.	5 m.	Unfav.	102	+	o	o	o	+	o
	Dis.	Prog.	III.	11 m.	Unfav.	103	+	Larynx.	o			
111	Adm.	Far ad.	III.	6 m.	Fav.	100	+	Larynx.	o	o	o	o
	Dis.	Prog.	III.	1½ y.	Unfav.	99.8	+	"	o			
112	Adm.	Far ad.	III.	4 y.	Unfav.	101	+	Larynx.	o	o	+	o
	Dis.	Prog.	III.	4 y. 3 m.	Unfav.	99.6	+	"	o			
113	Adm.	Incip.	I.	4 m.	Fav.	N	+	o	Syph.	o	o	10
	Dis.	Ap. cure.	H. les.	8 m.	Excel.	N	o	o	Syph.			
114	Adm.	Far ad.	II.	8 m.	Fav.	99.2	+	Larynx.	o	o	+	26
	Dis.	Ap. cure.	H. les.	1 y. 4 m.	Excel.	N	o	o	o			
115	Adm.	Incip.	I.	1 y.	Fav.	N	o	o	o	o	o	14
	Dis.	Ap. cure.	H. les.	1 y. 4 m.	Excel.	N	o	o	o			
116	Adm.	Mod. ad.	II.	3 m.	Unfav.	99	+	o	o	o	o	17
	Dis.	Ap. cure.	H. les.	8 m.	Excel.	N	o	o	o			
117	Adm.	Far ad.	III.	9 m.	Fav.	103	o	Miliary tub. glands.	o	o	o	o
	Dis.	Prog.	III.	10m. 2w.	Unfav.	104	o	Miliary tub. glands.	o	o	o	o

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
118	Adm.	Far ad.	III.	1½ y.	Fav.	99.4	+	o	o	o	o	38
	Dis.	Ap. cure	H. les.	2 y. 4 m.	Excel.	N	o	o	o			
119	Adm.	Mod. ad.	II.	2 y.	Unfav.	N	+	Ab. ear.	o	+	+	12
	Dis.	Imp.	II.	2 y. 6 m.	Good.	99	o	Ab. ear.	o			
120	Adm.	Far ad.	III.	1 y. 8 m.	Fav.	99.6	+	Larynx.	o	o	+	14
	Dis.	Imp.	III.	1 y. 11 m.	Good.	N	+	La. imp.	o			
121	Adm.	Mod. ad.	II.	3 m.	Fav.	99.6	+	o	o	o	+	o
	Dis.	Imp.	II.	11 m.	Good.	N	+	o	o			
122	Adm.	Mod. ad.	II.	3 m.	Unfav.	100	+	o	o	+	+	o
	Dis.	Imp.	II.	1 y. 2 m.	"	99.4	+	o	o			
123	Adm.	Mod. ad.	II.	3 m.	Unfav.	99.6	+	o	o	+	+	21
	Dis.	Imp.	I.	1 y. 3 m.	Fav.	N	+	o	o			
124	Adm.	Far ad.	III.	6 m.	Fav.	N	+	Larynx.	o	o	o	31
	Dis.	Ap. cure	H. les.	1 y. 2 m.	Excel.	N	o	o	o			
126	Adm.	Mod. ad.	II.	5 m.	Fav.	100	+	Larynx.	o	o	+	o
	Dis.	Imp.	I.	7 m.	Imp.	99.6	+	o	o			
127	Adm.	Far ad.	III.	10 y.	Fav.	99	+	o	o	o	o	2
	Dis.	Imp.	III.	20 y. 3 m.	Imp.	99.2	+	o	o			
129	Adm.	Far ad.	III.	5 y.	Unfav.	N	+	o	o	o	+	3
	Dis.	Imp.	III.	5 y. 3 m.	Better.	N	+	o	o			
131	Adm.	Incip.	I.	5 m.	Fav.	100	+	o	Ch. bron.	o	+	16
	Dis.	Imp.	I.	1 y. 1 m.	Excel.	N	+	o	Ch. bron.			
132	Adm.	Far ad.	III.	4 y.	Fav.	99.8	+	Larynx. ab. ear.	o	o	o	14
	Dis.	Imp.	III.	4 y. 7 m.	Imp.	99.6	+	Imp.	o			
133	Adm.	Incip.	I.	9 m.	Fav.	99	+	o	o	o	o	20
	Dis.	Ap. cure	H. les.	1 y. 6 m.	Excel.	N	o	o	o			
134	Adm.	Far ad.	III.	1 m.	Unfav.	103	+	o	o	o	o	34
	Dis.	Imp.	III.	7 m.	Good.	N	+	o	o			
135	Adm.	Far ad.	III.	6 y.	Unfav.	101	+	Lar. epi.	o	o	+	28
	Dis.	Imp.	III.	6½ y.	Fav.	99	+	Imp.	o			
136	Adm.	Far ad.	III.	1 y.	Unfav.	99.6	+	Fis. ano.	o	o	+	22
	Dis.	Imp.	III.	1½ y.	Fav.	99.4	+	Fis. ano.	o			
138	Adm.	Mod. ad.	II.	3 m.	Fav.	N	+	Larynx.	o	o	o	18
	Dis.	Imp.	II.	9 m.	Imp.	N	+	Larynx.	o			
140	Adm.	Mod. ad.	II.	3 y.	Unfav.	N	+	o	Ch. gas.	o	+	o
	Dis.	Prog.	II.	3 y. 5 m.	"	N	+	o	Ch. gas.			

Number.		Condition.	Involvement.	Duration.	General Condition.	Average Max. Temp.	T. B.'s.	Complications.		Hemorrhage During Treatment.	Finances or Temperament Unfavorable.	Gain in Weight. Pounds.
								Tub.	Non-tub.			
141	Adm.	Incip.	I.	3 y.	Fav.	° N	+	0	0	0	+	20
	Dis.	Ap.cure.	H. les.	3 y. 9 m.	Excel.	N	0	0	0			
142	Adm.	Mod. ad.	II.	9 m.	Fav.	N	+	0	0	0	0	20
	Dis.	Ap.cure.	H. les.	1 y. 4 m.	Excel.	N	0	0				
143	Adm.	Incip.	I.	5 m.	Fav.	99.2	+	0	0	0	0	12
	Dis.	Ap.cure.	H. les.	1 y. 1 m.	Excel.	N	0	0	0			
144	Adm.	Far ad.	III.	6 y.	Unfav.	N	+	0	0	0	0	0
	Dis.	Prog.	III.	6 y. 3 m.	Unfav.	99.4	+	0	0			
145	Adm.	Incip.	I.	3 m.	Fav.	100	+	0	0	0	0	24
	Dis.	Ap.cure.	H. les.	9 m.	Excel.	N	0	0	0			
146	Adm.	Mod. ad.	II.	3 y.	Unfav.	N	+	0	0	0	0	16
	Dis.	Imp.	II.	3 y. 10 m.	Fav.	N	+	0	0			
147	Adm.	Mod. ad.	II.	2 m.	Fav.	101	+	0	0	0	0	22
	Dis.	Imp.	I.	11 m.	Excel.	N	+	0	0			
148	Adm.	Mod. ad.	II.	3 m.	Fav.	N	+	0	0	0	0	27
	Dis.	Ap.cure.	H. les.	10 m.	Excel.	N	0	0	0			

Statistical Summary of Cases Under Treatment Over One Month

Total number considered 111.

Incipient cases 27 or 24 plus per cent.

Died;	Progressive;	Improved;	Arrested;	Apparently cured.
0 per cent.	0 per cent.	11 per cent.	18 per cent.	70 per cent.

Moderately advanced cases 30 or 27 per cent.

Died;	Progressive;	Improved;	Arrested;	Apparently cured.
3 per cent.	6.6 per cent.	56.6 per cent.	13.3 per cent.	20 per cent.

Far advanced case 52 or 46.8 per cent.

Died;	Progressive;	Improved;	Arrested;	Apparently cured.
5.7 per cent.	40.4 per cent.	26.9 per cent.	15.3 per cent.	11.5 per cent.

Two cases were admitted and discharged arrested.

Average duration of treatment 7.7 months.

There were 27 laryngeal cases or 24 per cent.

Hemorrhages occurred in 18 per cent.

Inadequate finances or unfavorable temperament operated against the patient in 53.2 per cent. of the cases.

Eighty-three out of 111 patient gained an average of 22.1 pounds.

Comparison of the results of treatment obtained by institutional management in a favorable climate with those obtained by like methods in unfavorable climates must convince the most skeptical that the advantage is all on the side of proper treatment in a favorable climate. We should, therefore, have sent to our western institutions every case in which the patient may be expediently sent far from home.

THE HOT MORNING BATH FOR THE TUBERCULOUS

By Norman Bridge, M.D.

Los Angeles

(Read by title.)

The cold morning bath has a widespread and high reputation in this country as a wholesome measure for both the sick and the well. A large number of healthy people believe that it has power to keep them well, and they take it regularly if not daily, and say that they enjoy it. They rise from their beds in the morning, get into tubs of cold water or sponge their bodies with it for from one to five minutes, then dry themselves and rub their skins thoroughly with coarse towels to produce the thing called a reaction. If the reaction is secured they have, on being dressed, a fine feeling of skin warmth, and a sense of power that is pleasant in the extreme. They come to breakfast with good appetites and start the day's work with vim; they have pink cheeks and lips, and look well.

Vigorous people with good physiologic power of heat production have little difficulty to secure the coveted reaction. But many weakly and sick persons, impressed with the value of the cold bath, try day after day, and try in vain, to get a similar reaction. They shiver during the bath and for some time afterward, and have blue lips and finger nails and pale faces for hours, with perhaps a slight headache and general discomfort of the limbs and joints. They do not find comfort or increasing vigor from the baths, but often go on taking them daily for months or years in the hope of benefits that are not realized. They do not like the cold bath; it is a daily ordeal to them; they hate it, but as they have been taught that it is a therapeutic and hygienic measure of great value; and feeling as they mostly do, that its use is an evidence of courage, if not of strength, they go on accepting its punishment.

A large number of consumptives both in and out of sanatoria are

taking this sort of a bath every day of their lives. It is prescribed in many of these institutions and believed by some of the physicians in charge of them to be a measure of very decided value. Some of those who are little sick are able to take the bath in water direct from the well or the hydrant, but the more weakly ones and especially the bed-patients are usually unable to stand the strain and must take a warmer bath or none at all. Some of these invalids, however, try long and suffer greatly in an unsuccessful effort to enure themselves to the cold bath before they acquire sense enough to give it up.

One of the curious facts connected with the practice of the cold morning bath is that so many of its votaries declare positively that they enjoy it. As a matter of fact, nearly every one dislikes the dash of cold water in the morning. They like the reaction if they can get it, which makes them feel good for hours, and so they say they delight in every stage of the bath, and doubtless believe they do. It is manifestly absurd that the average man, sick or well, should enjoy getting out of a warm bed in the morning and plunging into a tub of cold water; and the franker and more discriminating ones candidly confess that, except in very hot weather, they shudder at the cold water both before and after they enter it.

But it is in the popular mind, among many of the more fastidious of us, that a daily bath, or one nearly every day, is necessary for health. That venerable error which reads that "cleanliness is next to godliness" has become a part of the religion of a great number of people. Some kind of a bath must, they think, be taken, and the only one that is really pleasant, the warm or hot bath, is forbidden by lay opinion and to a large extent by professional opinion also, as being dangerous when taken in the morning, and so the cold one seems inevitable.

The hot bath is more agreeable to nearly everybody than the cold, but we have been taught for generations by putative hygienists, by books, professional and otherwise, by many thoughtful physicians, and a little, it may be, by an ethical fetish inherited from some severe religious past, that whatever is pleasant must be in some measure a sin—that a hot bath invites cold-catching and is therefore positively dangerous, unless taken just before going to bed, or unless it is ended by a douche of cold water or by a cold plunge. The theory that has gained currency is that the heat of the bath "opens the pores" and leads to cold-catching or some other peril, unless the "pores" are shut up by the cold dash taken at the end of the bath. So it has come to be a part of

the very positive directions generally given for a warm or hot bath, especially if taken in the morning or before going out into the weather, that the end event of it shall be this same cold dash.

Some have sought to explain all the effects of baths by their influence upon the circulation. Cold contracts the surface capillaries which drive the blood within, to be followed by dilatation of them in the reaction. Warmth, as of a hot bath, dilates the outer capillaries with, it is said, too much loss of heat from the body unless cold is finally applied to contract them—an assumption that is wholly gratuitous.

These theories take no account of the effect of the bath upon the nervous system, which effect is probably the largest factor in the influence they have on most people. There is reason to doubt the great benefit of much bathing, except to satisfy the demands of our esthetic conscience. Dirty people, and those who bathe their bodies once a week or month or year, succeed in living about as long, and keep about as healthy as those clean ones who wash their bodies every day. No amount of common dirt piled upon the skin in the ordinary vicissitudes of life can stop the pores against the slightest force of perspiration; the sweat lifts the dirt as easily as sprouting beans lift themselves into the air. But the nervous effect of the bath is doubtless real and often very beneficial, while it is at times positively harmful. The shock of the bath probably has an invigorating effect on many patients, but only if the reaction comes. It is an effect upon the nervous system chiefly, and perhaps helps the recuperative processes of the sick, although just how much might be impossible to demonstrate. But there is no proof that a hot, quick bath, without a cold douche, is not followed by as good and as useful a reaction as a cold one; and there is abundant proof that it is so followed.

The chilliness and other results of a failure of reaction after the cold bath are harmful in several ways, and especially so to an invalid. To him the cold bath unduly, unnecessarily and, I believe, injuriously, overtaxes his heat-making power in the morning when it is all needed for the day's work; and there is no proof that it has any other countervailing benefit.

In cold weather, and especially if (as is generally the case) the patient has a cold room in which to dress in the morning, he shivers from intropulsion of blood and is uncomfortable during this process, a cold bath without reaction mischievously adds to his annoyance. If the discomfort were the only effect, it could be ignored as a matter

of feeling; but a common and a worse consequence is catarrh of the stomach and bowels, resulting in slow digestion of the breakfast, if not of all the meals, and often in diarrhœa and so-called dumb ague, with numerous other discomforts of several sorts. Acid fermentation occurs with flatulence and eructations. The food is less relished and this of itself retards digestion. The best digestion is possible only when the eating is thoroughly enjoyed. A well man may, but a sick man rarely does, enjoy his breakfast when he is shivering with cold.

The best morning bath for both sick and well is a hot one, taken preferably rather quickly, much as many Japanese people take their baths. Managed in this way, it does not cause cold-catching, but rather prevents it—indeed, it is next to impossible for one to take cold from it. It is not merely comforting to take, it is positively delightful to most persons at any and all seasons of the year, and it starts one off to his breakfast and the day's work with the buoyancy and dash of the best reaction from the cold bath. It is not debilitating either directly as shown by subjective sensations, or indirectly through indigestion or any other fault of function; and this is a statement that cannot be made of the cold bath. The hot bath adds to the heat of the body—it may even slightly increase the temperature for the moment—and so prevents the sense of chilliness and discomfort of dressing in a cold room.

The best way to take the hot bath is with any kind of a tub, with, say, a foot depth of water at 104° to 108° F., the bather sitting down in it and abluting himself completely, and finishing the bath in five minutes. There is no harm, however, in remaining in the water ten or fifteen minutes, even lying down in it; but many people will believe there is danger in this last variation, and will hesitate to indulge in it.

To one who has known—as I have—of hundreds of people taking the hot bath, many hundreds of times in the aggregate, mostly in the early morning, and without the slightest discoverable harm of any shade in any case, it is strange that a popular prejudice against it should ever have come among our people; certainly there is no experimental ground for it, and so it must rest on theoretic considerations pure and simple. The experience and habits of other peoples are directly against such a prejudice.

Against this prejudice also is the fact that, taking the hot morning bath, patients with tuberculosis and other lowering diseases, as well as the rheumatoid affections, are generally much benefited—at least

that is the testimony of most of them, and this is borne out by all the appearances of their cases. Patients with migraines, neuralgias, so-called rheumatic gout and nervous debility, and who have tried unavailingly to improve on cold baths, have found immediate, albeit moderate, benefit from the daily hot morning bath. And the good effects have continued with the use of the bath through the months.

For safety and comfort, then, for freedom from disagreeable symptoms that may or may not be harmful, for certain positive benefits that cold baths usually fail to give, the hot morning bath is to be commended with great confidence as a daily resource and a daily joy. The cold bath is useful chiefly for those who least need the invigorating effects of any bath, that is, the well and husky people. The hot bath here described is valuable, and most valuable, for that great mass of our population who are below their physiologic par and who need every influence that can increase their strength and resisting power. Many of these half invalids and invalids, by the cold bath, are now, with true heroism, daily subjecting themselves to shivering discomforts often lasting for hours, and with no benefit—or worse than none—solely because of a false notion derived from the partial experiences of the strong. It is a shameful waste of courage and power in a good cause. The worst griefs in life are those that are preventable; and the cold-bath martyrdom is uncalled for.

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Philadelphia

Secretary

ROBERT G. LE CONTE, M.D.

Philadelphia

TUBERCULOUS PERITONITIS

By Richard Douglas, M.D.
Nashville

Etiology.—Frequency: In the year 1825 Louis pronounced the dictum that chronic peritonitis is usually of a tuberculous type. In the tuberculous subjects there is peritoneal involvement in 20 per cent. of the cases (Wothen). In 4,250 autopsies, Borschke found 1,393 cases of tuberculosis; of these 226 or 16 per cent. showed evidence of invasion of the peritoneum. Sixteen per cent. perhaps correctly represents the frequency with which tuberculous peritonitis occurs in tuberculous subjects in general at autopsy. Taylor Cummins reviews 3,405 autopsy records of the Pennsylvania, Philadelphia and University Hospitals. 24.5 per cent. presented some type of tuberculosis. In addition, 76 records showed healed tuberculous foci. In 11 per cent. of the cases of tuberculosis, there was peritoneal involvement. These are the "hard-worked statistics" referred to by Mayo, and really convey very little additional information to us, since it is well known that something over 60 per cent. of general autopsies reveal tuberculosis, active or healed. In 5,687 intraperitoneal operations at St. Mary's Hospital, Rochester, Minn., 3 per cent. were for some variety of tuberculosis. In the Massachusetts General Hospital, something like 4,000 patients are admitted yearly.

From 1889 to 1900, Shattuck found a record of 98 cases of tuberculous peritonitis treated in the hospital, both in the medical and surgical sides.

Rotch gives some idea of its frequency in early life. He found in eighteen years that there were 69 cases admitted to the Children's Hospital in Boston. Kissell says that it is far more common in children than is supposed. In 883 collected autopsies upon tuberculous children, Biedert found peritoneal involvement in 18.3 per cent. paralleling in frequency its occurrence in adults.

Age.—It is more frequently met with clinically between 20 and 40 years; yet there are no exact limitations as to age. Fifty-six out of the

98 cases studied by Shattuck were between the ages of 15 and 30. In children it is most common between the ages of 2 and 4. The common dicta regarding congenital tuberculosis are probably extreme. It is probable, however, that it is more common than is generally supposed. Miserocchi found measles or pertussis or both in the antecedents of 83 per cent. of 352 tuberculous children.

Sex.—The Mayos state that at the operating table they find about 4 females to 1 male with tuberculous peritonitis. Osler gives the ratio at 2 to 1. Konig collected 131 cases, 120 in women, 11 in men. This is quite a reversal of the old teaching from autopsy findings, as from them it is somewhat more common in the male sex. I rather think that this disproportion in favor of females has been exaggerated. When the element of sexual activity has been eliminated, as in children, we find it about equally distributed in the sexes as in the 69 cases in children so carefully studied by Rotch, 39 in boys and 30 in girls.

For adults the correct proportion appears to be about as Osler states, 2 females to 1 male. Kelly has shown that parturition is especially predisposing. On the other hand, hepatic cirrhosis, alcoholism and tuberculous peritonitis are concomitant phenomena, more common in males yet without any established sequence. Rotch and Mayo give family history of tuberculosis in about 30 per cent. of their cases; other authors place it as high as 70 per cent.

The essential factor in the production of tuberculous peritonitis is Koch's bacillus; and as this parasite must be looked upon as a plant of relatively high development belonging to the actinomyces, of the group of oöspora, it would therefore deserve the name of *oöspora Kochii* (Roger).

In the histogenetic study, it is necessary to admit such elementary facts as the following: The transmission of tuberculosis from animals to man has been demonstrated sufficiently. The question if tuberculosis is possible of transmission from lower animals to the human subject by means of meat, milk, etc., has lately been much discussed. Koch, the leader of the negative school, is opposed by Hamilton, who has reinvestigated the subject, and he, with the majority of authors, now hold that tuberculous contagion is transmissible from man to man and from man to animals; from animals to man and between animals of the same species.

Tuberculous peritonitis is one of the manifestations of lesions due to the action of the bacillus tuberculosis through one of its many channels

of infection. The oft-repeated statement that tuberculous peritonitis is always secondary, is practically the unchallenged dictum emanating primarily from such authors as Veit, Nothnagel, Teleky, Vierodt and a number of recent writers.

In view of conclusive proof furnished by Walsham, in his prize essay issued by the Royal Physicians of London, we feel that evidence will soon be forthcoming that the peritoneum may, like many other structures in the body, be the primary site of lodgement of the bacillus tuberculosis.

In seeking to trace the channel of infection of the peritoneum, we must bear in mind: That the tubercle bacillus is immobile; that it is of slow growth, and that it produces very varied tissue changes in those places where it locates itself (Walsham).

The channels of infection traveled by the tubercle bacillus are classified as follows: (1) Hereditary transmission; (2) lymphatic vessels; (3) blood vessels; (4) epithelial channels; (5) inoculation into the skin or tissues. We know that tubercle bacilli can pass intact mucous membrane and epithelium, and there are undoubted instances in which with a normal placenta, tubercle bacilli may be found in the placental blood and in the fetus. Chudovsky, in speaking of the etiology, says that there are cases known in which the fetus becomes tuberculous. Martin took particles from the lungs of a six and a half months' fetus whose mother had died of tuberculosis and injected it into the peritoneal cavity of rabbits with resulting death in 4 months.

In another instance the blood from a 5 months' embryo whose mother had died of phthisis was inoculated into rabbits with the result of general tuberculous infection.

Schmoll and Birch Hirschfeld found tubercle bacilli in the placenta and the capillaries of the liver in a child; the mother died of tuberculosis. Rindefleich found tubercles in the lungs of a child eight days old; mother was tuberculous. The above cases show that tuberculous infection may take place intra-uterine, through the circulation. The fetus may be infected by extension of a tuberculous process in the tubes to the uterus and the fetus contained therein. The spermatic fluid coming from a diseased testicle or epididymis may convey the infection.

Cnopp's statistics show that out of 298 tuberculous children from a few days to twelve years of age, no less than 147 had bone or joint tuberculosis. Only 8 of these showed evidence of visceral tuberculosis.

Baumgarten holds that the accidental conveyance of the tubercle bacilli to these parts would not account for such large proportion of cases and expresses the view that the bacilli have been present since birth and have developed when the conditions became favorable. Mafucci has shown that after infecting eggs with avian tuberculosis, the disease may remain latent in the chick for weeks or months; this is in support of Baumgarten's view, and these facts contain practically all that we can say upon the subject of inherited tuberculosis.

The process of eruption of metastatic tubercles is called hematogenetic, miliary tuberculosis. The blood channels have always been accredited with being a common mode of disseminating tuberculous infection. About tuberculous foci there is constant danger of the bacilli entering the blood current; this can occur through the lymphatics to the thoracic duct and thence into the venous system; or, the bacilli may gain entrance to the circulation through direct rupture of a blood vessel. The small blood vessels about an infected focus are always involved and become thrombosed and hence are not the carriers of the infection.

As Weigert and Benda (Walsham) have shown, a general miliary eruption of tubercle is consequent upon tuberculous disease of the walls of the large blood vessels. Under these circumstances, miliary tuberculosis may develop in the peritoneum as in other organs or serous membranes.

The next path of infection that we shall consider is the lymphatics. Sydney Martin has shown that the bacilli can pass through healthy intestine into the peritoneum without leaving visible evidences upon the surface, through open ulcers, an infrequent but well recognized mode of infection.

Professor Benda, at the meeting of the British Congress upon Tuberculosis, thus writes upon this point: "Whether tubercle bacilli can gain access through intact mucous membrane, is a matter extremely difficult to determine by methods of pathological anatomy . . . we find a large number of bronchical glands tuberculous, in which we do not discover a trace of any bronchial lesion." Walsham says: "From some observations of my own upon tonsillar and intestinal tubercle, I believe that the tubercle bacillus can be passed through a normal intact mucous membrane without showing the atrium of infection." Or, as Professor Hamilton, as quoted by Walsham, expresses it, "Can the absorbents of mucous membrane seize upon the bacillus and hand it on to the corresponding lymphatics without becoming tuberculous?"

He answers his own interrogation as follows: "My own impression is that they *can;* that the active point of invasion may, from local conditions, prove unfavorable to the development of tubercle and the bacillus is passed through them to a tissue more favorable for its growth." With this conclusion, Walsham agrees, after repeated observations upon tuberculous bronchial and cervical glands. He holds that it is certain that they receive their infection through the normal, intact epithelium of the trachea, bronchii or esophagus. The older theory that the bacilli pass through the lung and thus reach the bronchial glands is improbable.

It has been demonstrated by Dr. Litterer, of Nashville, Tenn., that mesenteric glands may become infected (proved microscopically and by Guinea pig inoculation), through the intestines without lesion to the wall of the gut. A very interesting question, which he has been seeking to elucidate, is the possibility of primary infection of the peritoneum from the alimentary canal without involvement of the bowel wall, mesenteric or retroperitoneal glands. In other words, can we have in this way a primary infection of the peritoneum? This has not been demonstrated; but there are many cases of tuberculous peritonitis in which it is impossible to discover a primary focus.

Reasoning by analogy from Walsham's investigation, in infection of the bronchial and cervical glands, may not the infection reach the peritoneum through the normal bowel wall?

It must be admitted that tuberculous peritonitis usually arises secondary to tuberculosis of the pleura, abdominal or pelvic organs, so that the continuous extension of the process is clearly demonstrable. Sometimes, however, this relation can not be traced; then, no doubt, the infection has been carried from some distant focus by the blood or lymphatic vessels.

In 226 cases of peritoneal tuberculosis, Borschke (Eisendraft) failed in only 2 cases to find a primary focus. The constancy of a primary source of infection in tuberculous peritonitis is noted by Primbran who states that out of 165 autopsies, 87 cases were attributable to intestinal tuberculosis; 65 to primary and glandular disease; 8 to tubal and uterine, and 5 to osseous tuberculosis.

Taylor Cummins, who has studied this relation so closely, states that in his series of cases 84 per cent. were complicated by pulmonary disease and 32.6 per cent. by intestinal disease.

The female generative organs, especially the Fallopian tubes, may be

the starting point of the infection to the peritoneum. From there the infection may be by direct inoculation or through the medium of the lymph channels. It has been said that post-mortems upon females showed from 25 to 50 per cent. of tuberculosis cases with tubal disease. Murphy and Mayo believe that the common source of infection in females is the genital tract, especially the tubes. Osler considers tuberculous peritonitis in women a common sequence of tuberculous salpingitis. Upon the other hand, Williams asserts that tuberculosis of the Fallopian tubes is far more frequently the result than the cause of peritoneal tuberculosis. That infection from without through the genitals is a mode of invasion seems established.

I have it upon the authority of Berkeley, that Morgagni, in 1744, was the first to record a case of genital tuberculosis. Literature is plethoric with the report of cases from Louis in 1825 to Pinner and Weigert in 1880, all taking the view that the infection was ascending; that is, from the genitals to the peritoneum. In 1880, Pinner found (Berkeley) that powdered cinnabar placed in the peritoneum of rabbits could, in a very short time be found in the vagina, being conducted from the peritoneum by the current of the tubal cilia; and it is presumed that in the same way tubercular bacilli could be wafted out of the peritoneal cavity into the genital tract. Of course it is understood that they got into the peritoneal cavity by their natural carriers, the leucocytes, from the bowel or through the medium of the lympatic channels from some primary focus, and it is remarked that, favoring this method of infection, the pelvis being the lowest portion tubercle bacilli gravitate to that region.

The causal relation existing between peritoneal tuberculosis and tuberculosis of the genital organs is somewhat misty. For a long time it was believed, in obedience to Pinner and Weigert's theory of gravitation, that the peritoneum was the source of genital tuberculosis. Murphy, in contending for this theory of gravity, comments upon his experiments which appear to confirm it, as follows: "Tuberculous products placed in the peritoneum of the monkey settle in the pelvis and are not carried by the lymphatic current in the direction of the diaphragm." These conclusions run counter to Muscatello and Clarke's investigations of peritoneal currents.

Against any theories we may entertain as to whether this infection is ascending or descending, is the clean-cut statement of facts by Mayo. "Having under observation a small number of patients in whom simple

laparotomy had failed in the permanent cure of tuberculous peritonitis, we began to do a radical operation, performing hysterectomy with removal of the ovaries and tubes. The condition of the uterus and ovaries on examination, did not justify so mutilating a procedure, the tubes showing unmistakable evidence that they alone were the source of infection. It became clear that in tuberculosis of the peritoneum in a very large majority of women, a lupus of the mucous membrane of the tube was a source of infection to the peritoneum."

Mayo dissenting from the idea of gravity advanced by Pinner and adopted by many, says: "The peritoneal involvement is greatest in extent near the seat of local infection. This has been generally noted, and heretofore ascribed to gravity. It is more likely due to the proximity to the seat of infection." The writer regrets his inability to express himself definitely upon this very essential point. The question is raised, but unanswered, by either of the three great classical writers upon genital tuberculosis, Berkeley, Williams and Murphy.

Understanding the nature of the tubercle bacilli, it is quite reasonable to assume that the Fallopian tubes may become tuberculous by ascending infection from the lower genital or urinary tract; or from drifting bacilli in the peritoneum. The causal agent of tuberculous peritonitis, the tubercle bacilli, may infect the peritoneum from the tubes, through the medium of the lymphatics or by direct inoculation. Tuberculous peritonitis occurs from the male genital organs, along the lymphatic vessels of the spermatic plexus or through the ampulla end of the vas deferens.

Prognosis.—Prior to Konig's first report, in 1884, tuberculous peritonitis was regarded as an almost uniformly fatal disease when treated medically. The effects of the operative treatment have been to teach us that peritoneal tuberculosis is often present without producing special symptoms, and with a natural tendency to recover more often than is even now conceded.

While the prognosis is not altogether bad, the gravity of an acute peritoneal infection, with or without recognizable primary lesion, cannot be overestimated. If we hold that peritonitis of this special variety is secondary to visceral or glandular infection, the peritoneal involvement may be arrested or controlled; but the ultimate prognosis will rest upon the activity of the primary lesion.

Peritoneal tuberculosis, appearing as a part of a general miliary tuberculosis, offers but little hope for even a temporary arrest. An

acute peritoneal involvement, though localized, may become rapidly general and be attended with such toxic symptoms that we should regard it with the greatest apprehension.

While Konig taught us the value of the operative treatment, he was among the first to advocate a selection of cases, and to condemn laparotomy as a uniform procedure applicable to all types of peritoneal tuberculosis. Medically treated, this affection is amenable to cure. Schroeder, in his medical clinic, obtained about 41 per cent. of cures. Rose, who cites articles by Borchgrevink who strongly advocates expectant treatment over surgical measures, gives these rather startling statistics: of 44 cases of tuberculous peritonitis, 22 were treated by operation with 64 per cent. of recoveries; 22 without operation, with 82 per cent. of recoveries, 68 per cent. of which were of over a year's standing. Spath long ago advocated conservatism, but not to the exclusion of surgical treatment. Caille, in a strong article, shows the futility of medical treatment of tuberculous peritonitis in children.

In uncomplicated subacute or chronic cases, the outlook is distinctly favorable. In very young children with a strong inherited predisposition and severe infection, the outlook is distinctly bad. The symptoms that affect the prognosis are: Continuous fever, rapid wasting; persistent diarrhoea and recurring exacerbations. The complications that make prognosis unfavorable are: Pleurisy, localized suppurations, caseation of the mesenteric glands and intestinal obstruction. Multiple sites of localization forecast a fatal ending.

The subacute and chronic ascitic forms are the most amendable to operative treatment. In only exceptional instances of complications and for the relief of special conditions should operation be undertaken in the fibrous form. The ulcerous form offers an unfavorable outlook; yet even these cases may eventuate in cure. After five different operations upon one patient, extending through a period of two years, the author had the satisfaction of seeing absolute cure follow from drainage of many caseous masses; the patient is now a woman grown, in perfect health and the mother of children.

All forms except the peracute are at least temporarily benefited, and a very conservative estimate of absolute cures can be placed at about 50 per cent. It will be a very difficult matter to eradicate from the active surgeon's mind these established benefits of the operative treatment of tuberculous peritonitis, and the day has not yet arrived when " surgery must hand back serous tuberculous peritonitis to the internal-

medicine clinic with thanks for the splendid opportunity which a misunderstanding gave to the profession by means of laparotomy, to study tuberculosis in one of the large cavities of the body" (Borchgrevink, Fenger).

Contraindications to Operation.—In general miliary tuberculosis medicinal hygenic measures should be first employed. Dry, fibrous peritonitis presents the greatest difficulties in operation; and as it indicates a stage in the process of healing, surgical measures should not be employed except to meet complications, such as intestinal obstruction. In the ulcerous form with great emaciation and prostration, operation is contraindicated. Lindfors holds that the existence of a pleurisy darkens the prognosis. Active lesions in other parts are contraindications to operation. Temperature is not a contradiction to operation; it specially indicates interference when it appears that the peritoneal tuberculosis is the only active manifestation.

In peracute cases, those of violent onset that resemble appendicitis or intestinal obstruction, the expectant treatment should be preferred to operation.

Surgical Indications.—Fenger's pronounced teaching against surgical interference in the ascitic form is met by the equally radical statement of Dennis that tuberculous peritonitis has been taken out of the realm of internal medication and transferred to clinical surgery. I must dissent from both these extreme views. If one author, Herringham, observed in the course of 5 years 25 cases diagnosed as tuberculous peritonitis, of which 19 recovered without operation and only 3 were unimproved; and if so careful a clinician as Shattuck whose analytical study of 98 cases leads him to conclude that tuberculous peritonitis may be followed by apparent complete recovery even if complicated by tuberculosis elsewhere, under purely medical treatment, we should surely hesitate before declaring this to be exclusively a surgical condition.

It is exceedingly fallacious to assume that the recognition of tuberculous peritonitis or supposed diagnosis of that condition, calls for immediate operation. In the exudative form we know that absorption takes place in those cases where there is marked improvement in the condition of the patient; resorption of the exudate can only take place when the functions of the body are in vigorous activity. It is obvious then, that should medical and hygenic measures fail to establish this standard of good health, then operative interference is demanded.

Too frequently it is stated that simple incision is sufficient. The

exudate must be completely removed. In the early stage this is especially necessary; for if the peritoneum is not immune the retained bacilli and their toxine keep up the peritoneal inflammation and the ascites will therefore reform. So in chronic cases, if some of the fluid is left, although the peritoneum may be somewhat immune, then irritation caused by retained fluid will lead to a reaccumulation of the effusion. Obviously then, laparotomy is necessary for complete removal of the exudate. All the fluid cannot be removed by mere puncture. Drainage is not desirable; indeed it leads to infection and both tube and gauze drainage may produce fecal fistula. Neither is it shown that irrigation is essential. Efforts should not be made to detach adherent viscera further than to free encapsulated fluid or to relieve obstruction. Germicidal irrigations and local applications are of very doubtful value. Enlarged, caseous mesenteric glands may be enucleated, though it is often a difficult task.

Guided by the teaching of Murphy and Mayo, we all recognize the importance of removing foci of infection when possible. This should invariably be done when the appendix or Fallopian tubes are the source of supply.

If the serous covering of these organs shows miliary tuberculosis merely as a part of general peritoneal tuberculosis, then it is useless to remove them. It is well to follow the general law established by Ochsner, "Remove the tuberculous tissue if the section can be made through healthy parts." We should exercise the greatest care in all our intra-abdominal manipulations; avoid abrasion and injury to the serous covering of the viscera. The general conclusion is justified that tuberculous peritonitis can be cured by laparotomy. The unsuccessful cases are those that have advanced disease in other organs. The probable rationale of cure is that the manipulation and exposure causes an afflux of normal serum which is antitoxic. We should not hesitate to subject the patient to repeated operations if there is reaccumulation of fluid, especially if the first operation has been early in the progress of the disease.

Operative results give a recovery rate of from 25 to 30 per cent. The immediate operative mortality is but slightly over 3 per cent; Mayo lost 3 cases out of 39. Cheyne says that in 385 operations, 53 per cent. of the patients were well 2 years after the operation. Rorsch presents statistics of 358 cases operatively treated, 250 of which were cured,

70 per cent.; 118 were under observation six months; 79 one year, and 53 two years.

Mayo contends strongly that tuberculous peritonitis has its origin in a local focus and the ultimate prognosis depends upon our ability to remove the primary site of disease. In 26 cases due to tubal infection in which he did the radical operation 25 recovered. Several of these had had previous operation with recurrence. The prognosis after treatment by both medical and surgical methods, has been carefully studied by Shattuck. Out of the 98 cases treated, the end-results are known in 57 cases. Twenty-five of these were treated medically, the ultimate mortality which reaches to a period of 11 years is 68 per cent.; 32 cases surgically treated mortality 37.5 per cent. From these figures we learn that tuberculous peritonitis may recover under simple medical treatment; and evidence is not wanting to show that an anatomical restoration may be obtained.

Tuberculous infection of the parietal wound does not occur. Pyogenic infection is infrequent. A complication to be greatly feared is the formation of a fecal fistula; it will not occur in the ascitic form unless drainage is employed; it is especially liable to follow in the ulcerous form. The fistulae are very obstinate; in Czerney's clinic in 3 out of 4 cases he failed to close the fecal fistula by suture; the author has had the same mortifying experience in 2 cases.

Pathology.—As a result of the stimulation of connective tissue elements, there is a proliferation of round cells. Around these there is an infiltration of leucocytes from the surrounding blood vessels. This leucocytic infiltration represents the reaction of the vascular system to the tuberculous infecting agent. In this stage the tubercle is an avascular, pearly body, in which there is no tendency to formation of blood vessels. Subsequently it undergoes hyaline, fatty degeneration or coagulation necrosis. The changes due in part to the insufficient blood supply and to the action of a tubercle bacillus.

In local infections the area involved may be very limited, or discrete tubercular nodules may appear over a greater or lesser surface. The most common sites of local infection are the pelvic peritoneum, appendiceal region, under surface of the diaphragm, and hernial sacs. In general miliary tuberculosis there is wide dissemination of the tubercular deposits over the visceral and parietal peritoneum.

In conjunction with the deposit of tubercular matter in the peritoneum there occurs a serous exudation; in acute cases it is often

hemorrhagic. Peritonitis, whether common or of this specific form, has as an essential part of its pathological process lymphangitis, with consequent lymph-thrombosis. The serous exudate is great or small as expressive of the acuteness and extensiveness of the lymphatic obstruction; hence in these cases of acute miliary tuberculosis general to the peritoneum, copious and unconfined serous effusion occurs. In the subacute forms the absorptive function of the peritoneum is only gradually lost; and while the exudate may be ultimately as great, it is more gradual in accumulation and often associated with plastic adhesions, confining the fluid effusion to the area involved.

In chronic peritonitis the changes that occur must be considered as anatomical evolutions in the life-history of the tubercular granulation. The separate tubercles are solid and surrounded by a pigmented area. As tuberculous peritonitis is commonly a secondary infection, the attenuated germ begets a fibrinous inflammation; and this is the striking feature of peritoneal tuberculosis, the tendency to fibrosis with sequestration and absorption of the tubercle; but should degeneration occur, that is, caseation of the granulation-tissue, masses of soft, cheesy consistency are formed, and with mixed infection there is puriform degeneration.

In the acute forms of tuberculous infection the peritoneum loses its pearly luster; it is red, granular, thickened, and hemorrhagic. With general involvement there is rapid accumulation of fluid and great distention.

In subacute cases with mild and progressive infection there is displacement and anchorage of viscera, welding of opposing peritoneal surfaces, and effacement of visceral outlines; the walls of the viscera are thickened and friable. The normal peritoneal pockets may be effaced, or else distended with effusion. Between the coils of intestines, viscera and parietes, in the recesses formed by false adhesions, loculi containing exudates are found. The mesentery is thickened, and, contracting, displaces the intestines. The omentum, infiltrated with tubercles, contracts and rolls into a mass which lies athwart the abdomen; or else from acquired adhesions acting as a partition, it may exclude the infected area. The fibrous formation, a stage in process of peritoneal tuberculosis, may be quite dry. Caseation is always attended by fibrinous deposit. In children especially, the parietal peritoneum becomes very thick and resisting-leather like. Mesenteric glands may be enlarged but not necessarily caseous. Thoracic glands and pleurae

most constantly show the tubercular changes. Tuberculous pericarditis is unusual.

The morbid changes are determined by the mode of infection, the virulence of the poison, the individual's resistance, and frequently by the occurrence of a mixed infection of intestinal or genital origin. If we bear in mind that the morbid changes are incident to an infection which may reach the peritoneum in any part of its wide area and in varying potency at different times, it will necessarily appear that the picture presented will not be uniform. An abdomen may reveal an area of recent invasion with discrete or confluent tubercular granulations, concealed by an encapsulated serous or sero-sanguineous effusion; in another part the tubercles are engulfed in the fibrous changes consequent upon the adhesive inflammation; and still elsewhere, at the seat of invasion and oldest infection, caseation with ulceration may be going on. A pathological classification offered by Aldibert and generally accepted by authors, based upon the conspicuous or prevailing feature, comprises the *ascitic, fibrous,* and *ulcerous* varieties. Aldibert makes many unnecessary subdivisions of these heads. Caille, and after him many others, confuse this simple pathological classification with a clinical variety styled *tubercular peritoneal tumors.* Every phase of tuberculous peritonitis may very properly fall under the three heads.

1. *Ascites:* In acute miliary tuberculosis there is a widespread deposition of tubercles over the peritoneum, accompanied by an abundant serous or sero-sanguineous exudate. These patients are succumbing to general tuberculosis, and are not subjects for operative consideration. In the less acute or chronic invasion there is a copious fluid exudate rich in albumin, transparent, brown or red from admixture of blood, or turbid with fibrin, exceptionally purulent, and of high specific gravity. It may be unconfined or limited to areas by adhesions. In the most chronic cases encapsulated effusions, one or many, are generally found. The prevailing feature in these ascitic cases is the abundant effusion, the absence of strongly organized adhesions, and the conspicuous appearance of the tubercular modules.

2. *Fibrous:* The inflammation excited by the bacillus tuberculosis may be adhesive from the first, or the more acute forms may become fibrous. In advanced cases the tubercular nodules have disappeared or are concealed by the new connective-tissue formation. The intestines are displaced and anchored; broad bands of adhesions unite the adjacent coils; other parts of the intestinal peritoneum, more acutely

affected, may be red and covered with more or less closely adherent flakes of yellow fibrin. All visceral outlines are obscured; and the abdominal organs have the appearance of plaster casts. The parietal and visceral layers of the peritoneum are thickened and leather-like; the normal peritoneal pockets are effaced; the omentum, abnormally attached, is stretched into a coil or roll, or else thickened, friable, and contracted upon itself; it lies as a hard tumor across the upper part of the abdomen; the mesentery, perhaps enclosing cheesy glands, is contracted and shortened, frequently drawing the intestines to the right; there may be no fluid whatever, but these dry adhesions practically obliterate the peritoneal cavity; or else encapsulated effusions, either serous or purulent, with massive fibrinous adhesions and agglutinated omentum and intestines, may form one or multiple tumors distinctly palpable and confusingly misleading in diagnosis. The nodules formed by connective tissue and degenerating tubercles are very large, and sometimes appear as pendulous tumors two centimeters in diameter (MacCallum). In these extreme cases of fibrosis all effusion has disappeared, and it seems as though nature is attempting obliteration of the peritoneal sac. In some instances the fibrous tissue appears to spring exclusively from the mesentery; in a recent case the author found cheesy degeneration of mesenteric glands making a mass larger than one's fist, and from this as a center, broad bands of fibrous tissue enclosing cheesy matter radiated in different directions, around, under and over which the intestines were almost hopelessly entangled.

3. *Ulcerous:* A caseating tubercle, from its tendency to destroy by ulceration the walls of the intestines, producing suppuration and fistulae, gives rise to the ulcerous form of tuberculous peritonitis. By caseous changes in the urachus, or by adhesions of a suppurating area to the anterior parietes, edema and inflammation of the abdominal wall is noticed, and occasionally a purulent or fecal discharge from the umbilicus appears.

Caseation may occur in an abdomen in which there are areas of tubercles. In others there is a curious medley of ascitic, fibrous, and suppurative peritonitis. This, as all other forms, may be local or general to the peritoneum. The fibrous tissue, of every degree of density and thickness, is a constant morbid change accompanying the caseation. While it is no longer denied that the tubercle bacilli are possessed of pyogenic properties, yet when there are puriform accumulations mixed infection is frequently found.

Ulceration of the intestinal mucous membrane accompanies the acute forms of miliary tuberculosis; it is not often found in the more chronic types of tuberculous peritonitis. Glandular enlargement and caseation of the thoracic, mesenteric, and retro-peritoneal glands, especially the retro-peritoneal pelvic glands, pleurisy, and pulmonary phthisis, latent or active, are common postmortem findings.

Symptoms.—History: A patient, the subject of tuberculous peritonitis, is frequently a descendant of tuberculous parentage. We are often able to establish some causal relation between the peritoneal eruption and some recent illness; pleurisy, pneumonia, inflammation of the internal genitalia, and in children the exanthemata, appear to render them susceptible to the invasion of the bacillus tuberculosis. Obscure abdominal pains, digestive disorders, anorexia, diarrhea or constipation, irregular fever, and progressive loss of weight, are symptoms of established importance. But we are so frequently confronted with peritoneal tuberculosis in individuals of robust health that too much consequence must not be attached to the history and previous condition. Abdominal operations have shown that peritoneal tuberculosis may be very latent. On the other hand, the onset may appear suddenly and violently, and be marked with such acute symptoms as to be mistaken for ileus or appendicitis. In other cases, especially in acute miliary tuberculosis, the febrile symptoms, gradually intensifying, may simulate typhoid fever; Osler repeatedly refers to this common error.

Associate Lesions: If it is correctly held that tuberculous peritonitis is a secondary affection, a great aid to its diagnosis is the detection of the primary focus. No examination is complete that fails to take in review the entire patient, directing especial care to the investigation of the lungs, pleurae, genitals, rectum, and colon. A preëxisting, concomitant, or secondary pleurisy contributes greatly to the value of other signs.

Temperature and Pulse: There is no characteristic temperature-chart in tuberculous peritonitis, nor can there be positive assertions made that the temperature is indicative of the stage and behavior of the disease. An acute disseminated peritoneal tuberculosis, suddenly appearing in one of robust health, may terminate within three weeks, and persistently low or subnormal temperature mark the whole course of the disease (Halstead). A suppurative condition with large collections of encapsulated purulent matter is not necessarily attended by fluctuating temperature. Osler calls especial attention to subnormal

temperature in the chronic forms of tuberculous peritonitis. Persistent temperature with evening exacerbations is usually noted in the acute and subacute forms of the ascitic variety. As the condition becomes more chronic the temperature declines. With caseation, especially when there are purulent accumulations, fluctuating temperature and sweats are usual. When the deposit is restricted to the pelvis by adhesions there is often an absence of pyrexia.

The pulse is influenced by the general toxicity, the degree of marasmus, the amount of distention, and the acuteness of the course of the disease.

Digestive Disturbances: The onset, especially in children, may be attended by vomiting, and this symptom may become so conspicuous in individuals of any age that, when coupled with the phenomena of distention and abdominal pain, we may wholly misinterpret its cause. In gradual infections there is loss of appetite. The bowels may be constipated, or diarrhea may be present. A mucous diarrhea is frequently due to intestinal ulceration, and suggests an active process in parts other than the peritoneum. In chronic fibrous peritonitis constipation is the prevailing condition. In these cases prolonged constipation, relieved by a spontaneous diarrhea, the progressive wasting, and the presence of a tumor suggest intestinal carcinoma.

Pain: In very acute cases the onset may be marked by violent pain. In fibrous peritonitis, pain, colicky in character and often severe, is due to the fixation and constriction of the intestines, requiring exaggerated peristalsis. In the ascitic and complex forms in which there is great distention, local or general, actual pain is not so pronounced, but there is great discomfort and abdominal heaviness, loin and sacral pains. Kelly emphasizes the value of pain on urination in women as a symptom of peritoneal tuberculosis. Pain is often caused by intestinal distention and relieved by free purgation. Respiration is often restrained because of pain on movement of the diaphragm and by reason of the associate pleurisy.

Menstrual Disturbances: In the early stage of tubal tuberculosis dysmenorrhea and metrorrhagia are common symptoms. With the progress of the disease and decline in the general health amenorrhea supervenes.

Physical Signs.—Inspection: The general appearance of the patient may in itself be suggestive. The entire integumentary surface may be pigmented, probably due to pressure upon the adrenals by enlarged

mesenteric glands; this symptom of pigmentation has been noticed without tuberculous involvement of the adrenals. In alcoholics with hepatic cirrhosis jaundice may be noticeable. In very acute cases ecchymoses and petechial spots have been observed. In the forms accompanied by effusion the abdomen is distended, usually symmetrically so in the more acute cases; irregularly enlarged when there is sacculation or localized infection. If there is great distention accompanied by emaciation the surface veins of the abdomen may be very conspicuous. The umbilicus is pouting; when suppuration is present there is an area of redness and edema surrounding it, and occasionally a discharge from it, serous, purulent, or fecal—This sign is regarded as pathognomonic. In cecal and appendiceal tuberculosis the distension is confined to that region. In chronic tuberculous conditions the abdominal distension is often due to tympany and is variable. In fibrous peritonitis the abdomen may be retracted, especially in its lower zone; and when partial intestinal occlusion occurs the exaggerated peristalsis is evidenced in visible patterns. The lower extremities in the latter stages become edematous; the swelling may be due directly to pressure from massive mesenteric tuberculosis.

Palpation: An acute infection with disseminated peritoneal tubercles is with rare exceptions attended by great effusion. The belly is smooth, elastic, fluctuant; the resistance is generally greater on the left side. In the more chronic cases the effusion has either disappeared or has never been a conspicuous feature; or if present it is encapsulated, yielding under palpation areas of unequal resistance with circumscribed elasticity or fluctuation. The boundaries of these circumscribed collections of fluid are irregular, ill-defined, and often incomplete; the fibrous adhesions uniting the intestines, omentum, parietes, and viscera form the limiting walls. The conspicuousness of the swelling and its palpability are conditioned largely upon the degree of tympany. In the most chronic forms, caseous and fibrous, irregular doughy tumors may be felt in any portion of the abdomen. The omentum, contracted, thickened, and infiltrated, forms one of the most characteristic signs in tuberculous peritonitis. The massing of intestines in dense bundles of fibrous tissue, the whole enclosing serous, caseous, or purulent matter, may form single or multiple tumors in any portion of the abdomen. In a recent case of dry fibrous peritonitis a tumor as large as an orange, visible and palpable, was due to caseous mesenteric glands. In children especially, the abdomen is tender in the acute forms. In all in-

dividuals tenderness, inconstant in location, may occur with recrudescence or from intestinal complications. In the fibrous stage there is often an insensitive condition of the abdomen. Pain may not be elicited in patients with tuberculous peritonitis by firm and deep pressure, but upon withdrawal of the hand and sudden expansion of the abdomen children will cry out with pain. In thin subjects, especially in children, the thickened and stiff parietal peritoneum may be recognized by rolling it between the palpating fingers. Crepitus may be both felt and heard in the fibrous variety. Gurgling sensations, due to intestinal stenosis or to shifting effusion, are more common. While fluctuation is common in the acute forms, it is not elicited when the disease pursues a more chronic course, either because of the absence of effusion or because of its loculated state. With suppuration there is edema, a doughy resistance, and increased tenderness of the parietes, most usually found in the umbilical region.

Vaginal examination, especially when the infection proceeds from this quarter, reveals a fixed uterus, a resisting indurated vault, the appendages cannot be easily outlined, and nodular, sensitive masses are felt. In males rectal examination may show pelvic glandular infiltration with great sensitiveness. Any tumor below the umbilicus can, by combined rectal and abdominal palpation, be explored, and its density and thickness estimated.

In hernial tuberculosis the empty sac is thickened, resisting and irregular; it refills quickly after emptying and there is no gurgling on taxis (Andrews). The spleen is palpably enlarged.

Percussion: In the ascitic variety the difference in the percussion-note, obtained respectively upon the left and right sides, is significant; a gradually increasing dulness as we percuss from right to left is not pathognomonic but quite significant; the rational explanation is that the contracting mesentery draws the intestines to the right. Areas of percussion-dulness may be found at the seat of any limited infection. It is in the *chronic caseous variety* with tumor-formation that we find percussion most valuable. These tumors, or cakes, when composed of matted lymph, omentum, and intestines, sacculating ascites or pus, are usually superficial and rest in apposition to the parietes. If operation is contemplated it is important to distingush them from cheesy glands, which underlie the intestines and produce palpable tumors, tympanitic upon percussion. It must be borne in mind that the physical

characteristics of intra-peritoneal tubercular tumors are susceptible of sudden changes.

Exploratory Incision: All symptoms and signs may be inconclusive, and diagnosis will be made only by an operative exposure. The microscopical picture is generally definite, and is confirmed by microscopical demonstration. In the ascitic form and in the advanced suppurative cases tubercle-bacilli may not be found in the effusion. Fibrous tuberculosis may be mistaken for carcinoma and papilloma of the peritoneum.

Clinical Types.—The clinical course which a tuberculous peritonitis pursues is either *acute, subacute,* or *chronic,* a division based not only upon the duraton but also upon the symptomatic behavior.

Acute Tuberculous Peritonitis: In acute miliary tuberculosis the peritoneal eruption may be only incidental to a more active focus, or it may constitute the predominating feature. And while effusion characterizes this pathological course, the rapid wasting, the hectic condition, the pyrexia, failing pulse, diarrhea, and abdominal symptoms may all suggest merely an enteric fever. These cases are not surgical in nature and concern us only in the differential diagnosis.

Subacute Tuberculous Peritonitis: A more gradual onset, with steady wasting, slight pain, progressive distention, localized or general, subnormal temperature with evening pyrexia, moderately frequent pulse, are symptoms usually associated with general or at least extensive tuberculous infection, producing a serous effusion with moderate amount of fibrous formation. If these cases pursue a more protracted course, pain becomes more conspicuous, constipation pronounced, localized areas of dulness appear, tumors are formed, tenderness is marked, emaciation progressive, while the temperature may still be an inconspicuous feature. The suspected pathological state in such cases is a sero-fibrinous peritonitis, with depositions of lymph and intestinal adhesions.

Chronic Tuberculous Peritonitis: Chronic peritonitis may be of the fibrous variety, and is exhibited in patients thin and gaunt, suffering with digestive disorders, but not necessarily with disturbance of temperature or pulse. The state of marasmus is due chiefly to visceral displacement and functional inhibition. Pain, however, may be a persistent and distressing feature. There is slight or no effusion, yet areas of dulness, due to fibrous thickening and massing of viscera, may be found. Sudden tympany, and paroxysmal pain and vomiting, attributable to partial intestinal obstruction, signalize and complicate the

clinical course. Great emaciation, fluctuating temperature, often high, frequent and weak pulse, profuse sweating, variable tympany, local tumors, hard or elastic, pain and tenderness, peri-umbilical edema and redness, possibly a purulent or fecal fistula, swelling of the extremities, are symptoms associated with caseous degeneration and ulceration.

Differential Diagnosis.—Appendicitis: Exceptionally the onset of tuberculous peritonitis is so acute, without even the suggestion of a prodrome, that the stormy attack is mistaken for appendicitis. Musser refers to such cases, one operated upon by Keen; but in this particular case the diagnosis was not in fault, a perforating tuberculous ulcer of appendix being found. The patient recovered from the operation to die in two months from general tuberculosis. Brunn has twice mistaken tuberculous peritonitis for appendicitis. Localized tuberculous cecitis and appendicitis, with caseous changes, have on two occasions led the author astray.

Enteric Fever: In the symptomatology we have referred somewhat in detail to the differential confusion existing between general miliary tuberculosis and enteric fever. This error arises chiefly through imperfect examination. In miliary tuberculosis the active pathological foyer, in connection with or remote from the abdomen, should be discovered. The sputa and urine will show the bacilli tuberculosis; and in enteric fever Widal's reaction may be obtained.

Intestinal Obstruction: Lejars says that the severity of the onset may simulate intestinal obstruction. These cases must be very rare, indeed. Fibrous tuberculosis may pursue a very masked course, when suddenly the symptoms of obstruction arise. The error is not one of present condition but of causative morbidity, and is entirely pardonable.

Ovarian Cyst: Sacculated adhesions resembling an ovarian cystoma cause the most common diagnostic error. To Spencer Wells's error we must acknowledge our indebtedness for the discovery of the surgical treatment of peritoneal tuberculosis. The general disturbance that attends sacculated tuberculous peritonitis, the location of the tumor, which is usually in the middle zone of the abdomen, though it may be in the pelvis, occasionally in the upper part; the history of the protracted illness and wasting, often antecedent to any abdominal phenomana; and the physical signs of palpation and percussion, are usually sufficient to prove discriminative, yet few surgeons of wide experience are guiltless of this error.

Intestinal and Peritoneal Carcinoma: Tumor formations in fibrous

and ulcerous forms of tuberculous peritonitis, in their chronic course, attendant general emaciation, pigmentation and jaundice, obstructive symptoms, pain and tenderness, simulate malignant neoplasms. The history of the illness, the presence of complications, the fluctuating fever, or else subnormal temperature, and chiefly its occurrence in young adults, distinguish tuberculous peritonitis from carcinoma.

Tuberculin.—Much has been written for and against tuberculin as an aid to diagnosis in incipient tuberculosis. Notwithstanding it is employed as a test by our best institutions, notably Johns Hopkins and is constantly used in the practice of such men as Trudeau, Klebs, Otis and Andrews, there is still an indifference or prejudice against it. Men habitually neglect to employ all means of diagnosis at their hand, especially when it entails any additional expense or trouble upon them. The accepted views concerning its value are well expressed in the conclusions of Dr. J. D. Madison, who has used it extensively.

1. Patients may react to tuberculin and no evidence of tuberculosis be found at autopsy.

2. The six cases following seem to demonstrate that completely healed tuberculosis may react.

3. Cases of proved tuberculosis may not react to the maximum dose.

4. The evidence is not conclusive that other diseases than tuberculosis may react to tuberculin.

5. The margin of error of the tuberculin test is considerable and probably not less than 10 per cent.

6. The maximum dose should be higher than 4 mg., and not more than 10 mg. Small increasing doses are not advisable, as the reaction is not so likely to be distinct on account of the tolerance which may be produced. An initial dose of 3 to 5 mg. followed by the maximum dose is better.

7. The temperature should usually be normal before injections are given. When the temperature is distinctly above normal a negative result is of no value, as these patients will frequently not respond at all, even to large doses.

8. It seems quite certain that the glycerin extract of tuberculin deteriorates, and a fresh bottle should frequently be opened, care being taken to keep it in a cool, dark place. The .5 per cent. carbolic acid solution should be made up on the day it is used if possible. I believe that deterioration of tuberculin is the principal factor in producing delayed reactions.

9. It cannot be said that tuberculin injections are entirely without ill effects, but their use among suitable patients is no more dangerous than the use of chloroform and ether for diagnostic purposes and is quite as justifiable as an early diagnosis of tuberculosis is of the greatest importance.

10. About 40 per cent. of all female patients admitted to the hospital react to tuberculin.

The author's experience with tuberculin test is limited and not sufficiently conclusive to prove materially helpful in diagnosis.

Very little accurate work has been done in estimating the value of leucocytosis as a physical sign in tuberculous peritonitis. Twenty-three out of 69 of Rotch's cases in which there was a blood count, gave an average leucocyte count of 16,435. In Shattuck's cases about 30 per cent. showed leucocytic count of over 10,000. LaConte records one case in which there were 50,000 leucocytes. This case recovered. In not a few instances the white blood count is below normal; this sign then is of very little clinical value.

DISCUSSION ON DR. DOUGLAS'S PAPER

Dr. William Litterer, Nashville: For the past year I have been conducting experiments upon animals (dogs, guinea-pigs, cats, etc.) with a view of ascertaining as to whether it was possible to produce tuberculous peritonitis from the alimentary canal without involvement to the wall of the gut, mesenteric or retro-peritoneal glands. The open question as to whether we can have a primary infection of the peritoneum is answered in the negative by such men as Veit, Nothnagel, Vierodt and a great number of recent writers. The results of my experiments have only been partially successful, in so far as demonstrating a primary peritonitis is concerned, but in the course of these investigations I have been able to demonstrate the passage of the tubercle bacillus through the normal intact mucous membrane without showing any evidence of lesions produced at the point of entrance. This is the opinion of Walsham, Harbitz, Theobald Smith, Ravenel and many other investigators. Baumgarten's views run counter to the above. He insists that tubercle bacilli always produce some lesion at the point of entry into the body. It would be impossible in the short space of time allotted to me to go into detail the various experiments that I have been conducting, but will have to content myself with only

a brief résume of the subject. These investigations will be published in detail some time subsequently.

In the experiments, dogs, guinea-pigs and cats were used in seeking to elucidate the possibility of a primary tuberculous peritonitis. Some of the animals were purged, others were given opiates and similar drugs. Some were starved, while others were over-fed; the kind of food was also taken into consideration. Both human and bovine tubercle bacilli (young and old) were used and grown on different media. Without giving in detail my results, which were in the main negative, I will simply relate the method that I am using which has proven the most successful in attempting to arrive at a solution of this very vexing problem. Dogs proved to be the most satisfactory. They were immunized (which by the way is slight) by several interval injections of a suspension of dead tubercle bacilli, killed at sixty degrees Centigrade. When this slight immunity was obtained, the dogs (six in number) were then fed on attenuated bovine tubercle bacilli which were placed in a capsule so as to insure against infection of the mouth, throat, tonsils, etc. From five to ten weeks later the dogs were killed, and in only one instance was there revealed no evidence of intestinal lesions, both macro- and microscopically, but the mesenteric lymph nodes were involved (proved microscopically and by guinea-pig inoculations). All the dogs with the above exception showed some lesions of the intestinal tract and in three there were in addition a few miliary tubercles scattered here and there in other viscera. Later I have been more successful in not producing the intestinal lesions. This is done by feeding the immunized(?) dogs with the sputum from a case of chronic phthisis (that has been running for several years without any very marked change in the condition of the individual). Two out of five dogs thus experimented, when killed showed no intestinal lesions. Both had slight mesenteric glandular enlargement. In one of these there was no distinct peritonitis as could be made out macroscopically, but my suspicion was aroused as to the beginning of such a condition by an excess of fluid in the peritoneal cavity. This fluid was inoculated into several guinea-pigs, all of which died of tuberculosis, showing possibly if the dog had not been killed for perhaps several weeks longer a genuine tuberculous peritonitis might have developed. The object in producing in these dogs as near an immunity as possible is to prevent an acute general miliary tuberculosis which occurs quite frequently in the non-protected animals. I have made like experiments

along this line on guinea-pigs and cats. Similar experiments may have been made by other observers, and as Professor Theobald Smith aptly states, the literature on tuberculosis has grown to such stupendous proportions, and any one who enters this field with any suggestions or theories is certain to do injustice to some precursor, for almost every possible interpretation has been stated somewhere before.

Dr. Alexander H. Ferguson, Chicago: Inasmuch as the paper of Dr. Douglas is so complete and replete, and the discussions are so pointedly to the subject, I feel that any remarks of mine are probably superfluous and that my function is performed by thanking Dr. Keen for the honor of my name appearing on the programme and complimenting the essayist. I did not come here, however, to be guided by my own impulses in this matter. I, therefore, crave your attention for a few minutes.

Ever since the enigma of septic infection after operations was practically solved by Lister, surgeons the world over have not hesitated to explore with the knife and hand regions of the abdomen diseased or suspicioned of being diseased, that previously were considered too dangerous to survey. Among the many structures within the abdomen that fall a prey to tuberculosis the great serous lining of all is frequently invaded. As Dr. Douglas has pointed out, tuberculous peritonitis runs its course of more or less destruction uninfluenced by any known drug or combination of drugs that may be administered for its relief. The acute and subacute cases of the disease are usually diagnosed by laparotomy and that too often while searching for something else. Many of the chronic cases are beyond relief by the time a diagnosis is made. This unwelcome visitor, tuberculous peritonitis, accidentally entered the realm of surgery like many other diseases within the abdominal cavity, just when the patient was sliding into eternity.

Mirabile dictu, even the opening up of the abdomen, liberating ascitic fluid or flushing the cavity sometimes results in a prompt and permanent cure. At the present time that tuberculous peritonitis is a surgical disease is, to my mind, incontestible. It does not seem reasonable for a disease of germ origin, as this one is, to remain in this category for all time. When laboratory workers discover a cure, probably a serum or a combination of materials, that is capable of cutting short its progress and obtaining results superior to those of operative procedures, then the surgeon will rejoice in re-assigning tuberculous peritonitis to the physician.

The explorative incision reveals conditions in the life history of the

disease that are not found at a post-mortem. The fluid, tubercles, fibrous tissue, constricting bands, contracted mesentery, rolled up omentum, occluded bowels, invaded organs, choked up lymphatics, and even the ulcers and sloughs observed within the body of a living person look different, feel different, and are different, to the post-mortem revelations of this same disease.

For an explanation of many of these phenomena we must look to bacteriology. It seems to me the time has come when the surgical treatment of tuberculous peritonitis must be less accidental and more scientific. The bacteriological chemist must join hands with the surgeon more frequently for the elucidation of many mysterious questions connected with inflammation of the peritoneum. The anatomy and physiology of the peritoneum are fairly well known and so are its pathological changes. The bacteria causing the various diseases within the abdomen have also been assiduously studied, but the influence the product of one bears upon the life of the other is still more or less of a conjecture.

Tuberculous peritonitis is often a mixed infection or is engrafted upon portions of the membrane damaged by the influence of some other germ, such as the typhoid bacillus, the gonococcus, the colon bacillus, etc. It has been demonstrated that the staphylococcus albus, a germ of very low virulence, is most frequently found in peritonitis; the first present, the last to leave and always associated with phagocytes, peritoneal exudates, adhesions and repair. Dudgeon and Sargent ("The Bacteriology of Peritonitis," 1905, p. 13) have concluded from their researches that they do not know how or why the staphylococcus albus appears, but having arrived, it seems to provoke the appearance of a clear fluid exudate, which soon becomes turbid from the presence of innumerable phagocytic cells and by this means exercises a protective action in peritonitis.

It was shown by Issaeff in 1894 that various sterile solutions previously injected into the peritoneal cavity of guinea-pigs could render the peritoneum less liable to infection with certain pathogenic germs.

In 1895, Melsome and Cobbett, experimenting with cultures of streptococci, produced immunity by successive minute inoculations. Durham secured immunity in rabbits by the injection of sterile fluids. Salieri and Miyake, working under the late Professor Mikulicz, produced artificial immunity in animals by preliminary intra-peritoneal injections of sterile saline solution, nucleinic acid and other substances. (Dudgeon

and Sargent.) Durham pointed out that the protection offered depended largely upon the appearance of phagocytic cells in the peritoneal exudate. These data bear more or less upon the surgical treatment of the subject under discussion. In discussing the surgical treatment of tuberculous peritonitis I probably can be more succinct in my remarks by being somewhat dictatorial, as follows:

Open the abdomen below the umbilicus in the acute or subacute cases as soon as the diagnosis is made or to make a diagnosis; pass the hand and feel every structure within the peritoneal cavity in search for a primary focus, and having found it, remove it and the structures involved if practicable, whether it be the fallopian tubes, uterus, ovaries, appendix, gall-bladder, section of bowel, etc.; do not wash out a turbid or milk-like fluid, because the phagocytes in it are the principal curative agents provided by nature; this is in keeping with bacteriologic experiments. Wash out clear looking ascitic fluid, for it has no curative effect, is not easily absorbed, presses upon internal organs, renders them anemic and hastens the spread of the disease; fill the abdominal cavity with a normal salt solution when clear peritoneal fluid is removed and smear iodoform emulsion (ten per cent. glycerine) over the diseased parts; the solution and the emulsion are both germicidal, and at the same time induce a prolonged congested condition of the peritoneum which is most conducive to the encystment of tubercles; drain always with silk-worm gut, but not with tube or gauze in all acute or subacute cases with ascitis,—capillary drainage into a large dressing provides against immediate over-distension of the abdomen with new fluid; and do not hesitate to freely handle the intestines for thereby a decided determination of blood to the peritoneum occurs which materially aids repair and prohibits the multiplication of the bacilli.

In 1889 (December) I opened the abdomen of an Icelandic girl, sixteen years of age, suffering from ascitis of short duration; her liver was greatly enlarged and I judged an hydatid cyst was the cause of it. The incision was above the navel. The peritoneum over the liver, gall-bladder, stomach, intestines, spleen and abdominal parietes was studded with tubercles nearly all about the same size. The intraperitoneal fluid was opalescent and whitish. I searched for but found no primary focus. It being my first case of this nature and not knowing what best to do, I simply closed the abdomen. To my astonish-

ment she made a prompt recovery, and a permanent cure resulted. She is now alive and well and the mother of a family.

I shall now refer to another form of acute tuberculous peritonitis which was not only acute but fulminating, following confinement:

Mrs. B. Age 26, dipara, history of bronchitis, had two asthmatic attacks, the last when two months on in her last pregnancy and lasted about five weeks. No bacilli at any time; all physical signs negative from four months to confinement; labor short and normal; her abdomen seemed normal until the fifth day after labor, when the bandage was noticed to be too tight, then free fluid was detectable by palpation and percussion. Dr. Gentles, the attending physician, found it imperative to remove by tapping two gallons of fluid on the tenth day. Upon emptying the abdomen fairly well, he detected distinct localized thickenings of the inner aspect of the abdominal wall. In a few days a second tapping was done and the abdomen suddenly refilled. About four days after this (November, 1900) I saw the case in consultation with Dr. Gentles. Two days later, I performed a laparotomy, and removed about three quarts of free pale fluid more or less turbid. The whole peritonitis was greatly thickened and studded with pearly plaques, concentric and confluent, some forming nodules of considerable thickness. No primary focus was detected. The uterus, ovaries and tubes were most involved, and with coil of bowels seemingly obliterated the pelvic cavity. Coil upon coil was feebly adherent to each other and to the abdominal parietes. I drained the abdomen in different direction with gauze soaked in iodoform emulsion. In a few weeks she was up and about; there was no return of the ascitic fluid; she went to the country and gained in flesh. In four and a half months, however, after the operation she died of general marasmus, without any physical signs of pulmonary or distressing peritoneal tuberculosis.

I allude to these two cases to illustrate that early surgical interference is not contraindicated in acute tuberculous peritonitis.

In chronic tuberculous peritonitis I open the abdomen over the most prominent part, explore with the hand, break down cheesy material, and moderately firm adhesions, liberate encysted fluid, thoroughly flush away tubercular debris and sloughs with a copious saline solution at a temperature about 116° F., then bail out the fluid and mop dry, smear iodoform emulsion over the diseased parts (not more than an ounce), close the abdomen but insert tube and gauze drainage in one or more places as the case requires. Intra-abdominal tubercular abscess is treated by evacuation, insertion of iodoform emulsion and drainage.

In intestinal obstruction either switch off the obstructed bowel by a lateral anastomosis or resect. In this connection allow me to briefly refer to a remarkable case:

Miss T. Age 26, operated for right tubal tuberculosis in 1899, a fecal fistula followed. In 1900 she came under my care. I performed a panhysterectomy, also removed the left tube and ovary, excised the fistulous track

which led to the lower end of the sigmoid. The bowel seemed normal. After paring the edges the opening of the bowel was sutured with two rows of sutures, catgut for the inner and silk for the outer. In separating the uterus from the bladder, both were so friable from tubercular infiltration that my finger broke through into the bladder. The rent was closed by sutures of catgut. The abdomen was closed and drainage provided per vaginum and suprabubic. In ten days faeces was passing through the abdominal wound, vagina and rectum. In nine weeks all fistulae closed and bowels moving per vias naturales. In eighteen weeks she returned with obstruction of the bowels which came on gradually. Laparotomy revealed two obstructions, one in the small bowel and the other in the large. It was necessary to resect 26 inches of the ilium and 8 inches of the sigmoid, using a Murphy button for each. The peritoneum (over the rest of the bowels, and the parieties) was studded with miliary tubercles. The specimens removed were infiltrated, ulcerated and constricted.

It was a great astonishment to me that she made an uninterrupted recovery. She is now living in Rockford, Illinois, enjoying good health and able to do her own house work and travel with ease and comfort. I mention this case to encourage surgical procedures even in most extreme cases of chronic tuberculous peritonitis.

THE TREATMENT OF TUBERCULOSIS OF THE BONES AND JOINTS

By Joel E. Goldthwait, M.D.

Boston, Mass.

In presenting a subject of such magnitude as the title of my paper implies it is impossible, in the time allotted, to do more than to mention the essential features which are the basis of all treatment, giving due emphasis to the prevention of the disease, that which represents the special work of this association.

It should be remembered in the first place that the disease under consideration is tuberculosis, and that while the structures involved may differ histologically from those in which the condition is more frequently seen, the essential characteristics, nevertheless, are the same. Bone is naturally of greater density than the soft tissues, and consequently the time required for the development of the disease in such a tissue must be greater, this being also true in regard to the disintegration of the necrosed tissue and the final cicatrization. Except, however, for this fact, the disease is the same, having the same general pathology, the same variations as to types, the same prognosis, and requiring the same principles of treatment, as apply to tuberculosis in any other portion of the body.

The disease is, of course, due to the presence of the tubercle bacillus acting locally in the part affected, and it is usually possible to demonstrate the presence of the organism if the tissues can be subjected to examination, or if the tissues themselves cannot be examined, it may be found in the pus or detritus resulting from the disease. The mode of introduction of the bacillus to the body and its transmission to the seat of the lesion is frequently a matter of conjecture, but whether it came through the respiratory tract, or the intestinal tract; from some external wound, or in some other way, is a matter of little importance in planning treatment for the local lesion, unless this local lesion represents an extension of the disease from some other organ.

Pathology.—A thorough knowledge of the pathology, and especially the gross pathology, of bone and joint tuberculosis is of the utmost importance in considering the problems of the treatment, as it is only by being familiar with the many gross appearances that the conditions for which treatment is sought can be properly interpreted.

The tubercular lesion in the bones or joints differs from the disease in the soft parts only as one would except from the different density of the structure in which it develops. The bacillus produces an individual tubercle, which in its development causes the destruction of the tissue immediately surrounding it. The tubercle develops by extension from the periphery with the softening or caseation at the centre, and by the fusion of many of these tubercles a cavity or abscess results. In bone after the process has continued for some time the bony trabeculae included in the caseous area soften and become detached, either as small particles, or if the area involved is greater, a mass of necrosed bone is separated, a sequestrum. With this and as a part of the disintegration which goes on in such a disease, the bone abscess is formed. In such an abscess, whether in the bone or elsewhere, it is to be remembered that the disease is constantly developing at the periphery, and that the abscess is only the softened center of the diseased area, so that the periphery, or wall of the abscess, is made up of individual tubercles fused together, suggesting in appearance a membrane, the so-called pyogenic membrane.

The process in bone is almost invariably seen in either the small bones or in the cancellous ends of the long bones, and very rarely is the dense cortical bone affected. The process starting thus in bone, extends in all directions and may in this way involve the joint or the soft structures surrounding the bone. In the knee the favorite seat of the disease is in the epiphyses of the femoral condyles or in the head of the tibia. From the femoral epiphyses the bacilli find their way to the joint surface through the intercondylar notch, or more peripherally along the edge of the trochlear surface, external or internal. If the extension is directly from the bone the cartilage is involved first where it joins the bone, leading to its becoming detached, so that at times one sees the entire cartilage covering a condyle lifted off, the separated surface being studded with miliary tubercles. At other times, if the extension to the joint is different, a reddish, vascular, granulating pannus may grow in over the margin of the cartilage, with the resulting destruction of the portion beneath. The entire synovial membrane may be infected, and

then one detects a purplish, infiltrated, but only mildly villous thickening of the entire parietal membrane. Under such conditions there is commonly some excess of fluid in the joint, and this contains in greater or less amounts caseous material and general detritus which results from the development of the disease. The entire cartilage at times looks bluish, with red streaks in various places where erosion is imminent, either from above or below.

Joint tuberculosis does not always start in the bone, but it may be primarily a synovial process, the bone being involved secondarily. This can be proven pathologically, and there is also abundant clinical evidence in support of such a statement, beside the fact that tubercular lesions are found in every other serous cavity of the body, and there would seem no reason to exempt the synovial structures.

In bone and joint tuberculosis one of the great difficulties lies in determining the limits of the process and also what represents repair, both in the bone and in the soft parts. On opening the large joints, *e. g.*—the knee—the cartilage may seem intact, but will be found to cover, as with a lid, a large cavity in the bone beneath. This cavity will contain active but possibly slumbering disease. Repeatedly have I seen such cavities in an active eruptive stage with granulation tissue growing up out of the cavity and infecting the synovia in the immediate neighborhood. On opening such a joint the general appearance of the articulation may look normal except that the synovial membrane may be slightly thicker than usual but without villous change. A reduplication of the joint membrane will be found folding itself over the cavity above described, and when this is incised it will be possible to demonstrate active disease within. There may be very little restriction of motion in such a joint, and it is in this kind of an articulation that conservative surgery finds its most favorable opportunity. In it there is a considerable portion of the articular surface which is intact, and there is a protective cordon of fibrous tissue shutting off the slumbering focus from the healthy tissue of the joint, so that extirpation of this area, if thoroughly done, should eradicate the disease and preserve whatever motion was already present.

The pathologically hopeless joint in the adult is the one in which there is a considerable amount of flocculent exudate with thickened, vascular, synovial membrane, eroded cartilage, and an eroding pannus creeping up over the borders of the trochlear surfaces. In such a joint the control of the disease is not only difficult, but oftentimes impossible.

If the process is arrested in such a joint, as it may be even after extensive destruction has occurred, the eroded bone is never replaced by new-formed bone, but the necrotic area is filled in by a fibrous tissue alone, or by a combination of the calcified detritus from a cold abscess and fibrous tissue. The repair of damage done by tuberculous disease which has stability to it is dependent upon the completeness of the fibrous infiltration of the focus and the obliteration of the cavities produced by the disease. It is in these cavities, if not closed, that tuberculosis lurks with the potential of recrudescence. It is for this reason that central lesions, that is, those which are situated in the body of the epiphyses and which do not open widely into the articulation, are more dangerous than the erosions which extend into the epiphysis from the joint side and thus have as a rule a wider portal of entrance.

The practical bearing of the knowledge of the method of repair is of great value from the view-point of surgical pathology. It affords a probable explanation of the capacity of childhood and youth to combat tuberculous lesions so successfully, inasmuch as the rapidly growing tissues of early life have greater propensities for the manufacture of fibrous tissue, and in the second place, in the adult where radical measures in the treatment of surgical tuberculosis have so much wider application, it enables us to decide upon the proper time to interfere in cases suitable for erasion. The chance of dissemination of tuberculous disease by such procedures must be reckoned with, but such risk will be most certainly greatly diminished if we allow enough time for fibrosis to become established about a tuberculous focus. Where this has not taken place and surgery is undertaken raw bone surfaces are laid bare and infective material may be thrown directly into the local circulation, and from thence a general miliary process may be imposed upon the individual.

Joint and bone tuberculosis occurs most frequently in childhood, as is true of most of the so-called non-malignant forms of bone disease, at the period when the bones are soft before complete ossification has taken place, but it is also to be borne in mind that there is no age in which there is exemption from the disease.

Treatment.—In planning the treatment of such a process it is to be remembered that the course of the disease is the same and that there are the same variations in type as is true in tuberculosis of the other organs. In the lung it is not infrequently the case that the course of the disease is rapid, so that a fatal termination is the result of a few months, while,

on the other hand, it is also true that not infrequently the disease, which is equally definite in its nature, may exist in the lungs, producing comparatively few symptoms for many years with ultimate recovery. Just what determines the wide difference between these two types, whether the individual susceptibility of the patient or the virulence of the organism, is a matter of question. One or the other, probably both, of these factors must be of importance, as certainly the wide difference cannot be explained by treatment or lack of treatment, for many times those who can have the most ideal treatment succumb most easily, while at other times the reverse is equally true.

With the disease in the bones and joints, the same variation occurs, and in one instance a very acute and destructive type exists, causing great impairment of function of the part, while at the other extreme is seen a mild course with little suffering and with little disturbance of function, and between these two extremes there are all possible modifications. All of this must be borne in mind in planning treatment, as well as in making prognoses, never forgetting that the process is tuberculosis, possessing all the peculiarities of that disease, and that while mechanical measures form a large and essential part of the treatment, nevertheless these cannot change the type of the disease, and all that can reasonably be expected is that the severity may be modified and the inevitable development of deformities may be prevented. In the mild form of the disease the symptoms may subside in a few months, and the treatment be safely discontinued in a comparatively short time, while in the severe type, many years may be necessary before the process is healed, and a considerable portion of that time may represent suffering to the patient in spite of our best efforts to relieve.

In considering the treatment it should be clearly borne in mind that because the patient has tuberculosis, it does not necessarily mean that he is doomed or that there is reason for the panic so often seen with both the profession and the patient. The disease is undesirable, naturally, as is true of many other diseases, but because a bone or joint or an organ of any kind is affected with this disease it does not necessarily mean that that part of the body must be removed. We are dealing with an infectious process, which in many instances may produce destructive changes with much resulting mutilation and with frequent extension of the disease to other organs, but which in other instances, even under unfavorable conditions, and still more often under favorable

conditions, gets well with little resulting impairment of function of the part which had been affected.

It is our duty as physicians and surgeons to recognize these two extremes and to decide in each case just what policy is to be followed and why that policy is used. If the patient is in good general health, with no loss of weight, no elevation of temperature, or other symptoms to show that the tubercular organisms have not been kept under control by the natural elements of resistance in the given individual, there certainly is no reason to feel that the area of disease must be at once removed, any more than it is considered necessary to excise every pimple or pustule which may contain the streptococci. Naturally, these organisms are not desired by any of us, and we avoid so far as possible their introduction into our bodies, but while we know that under certain conditions they cause great disaster, we realize that under ordinary conditions, nature, if she have a fair chance, is amply able to protect herself against such elements. The same thing is true of tuberculosis, and if nature is given a fair chance the disease is controlled by those elements of resistance with which we are all endowed, but regarding which we are extremely ignorant.

In facing the treatment of tuberculosis the first motive should be to preserve the life of the individual, and to do it with as little mutilation as is possible. If to save life it is necessary to sacrifice a leg or an arm, a kidney, or any other organ, by all means sacrifice that part, but let us be sure first that the part must be sacrificed, remembering that in a large number of cases such radical measures are not required, and that an organ which may lack even a part of its function is better than no organ at all, or that a member which may lack much in the normal amount of function is usually far better than artificial contrivances, however perfect may be their construction.

In such treatment the consideration of the general health is of the utmost importance and should not be overshadowed by the surgical or mechanical treatment, even though the immediate results of such measures are much more apparent. Life in the open air, with an abundance of sunlight, together with proper bathing and good food, is important, and in general every detail of hygiene should be supervised with the same care as is considered desirable in the treatment of tubercular disease in the lungs. It is by such measures that the vitality of the individual cell is increased and the resistance to the extension of the disease is made possible, and it should be remembered that while these

measures are of the utmost importance during the entire course of the disease, they are of importance also throughout the entire life of the individual, and if adhered to undoubtedly represent the greatest possible factor in the prevention of the disease. Life absolutely in the open air, the living in tents or shacks, such as is desirable during the active stage of the severe types of the disease, is not, of course, necessary for a permanent mode of living, but the proper ventilation of the rooms, with plenty of sunlight, with proper bathing facilities, and with a reasonable amount of good food, should be possible, and is always desirable, not only for those already affected, but also as the best preventive measure for those not yet diseased.

For internal treatment, aside from an abundance of good food, there is little required, other than such things as would relieve special symptoms or would improve or aid in the nutritive processes.

For local treatment the general principle consists in the preservation of the function of the part, so far as is possible, without increasing the irritation at the seat of disease. In pulmonary disease it is not the custom to bind up the chest or in any way to restrict the respiratory function, but, on the contrary, life in the open air with considerable exercise and in high altitudes where the respiratory effort must be greater, with special exercises to still further use and develop these organs, are all considered important and are advocated up to the point of toleration in the given individual.

With the disease in the bones or joints the same principles hold, and instead of confining the part absolutely, function should be allowed as in the lung up to the point of toleration. The degree of limitation must vary with the individual case, owing to the fact that there are different types of such disease, or different degrees of virulence, and also because of the different stages, whether late or early, whether with or without deformity, of the given type. The confinement of not only the affected joint but also the joints adjacent, as is so very common, notably in hip disease, should be avoided as a routine measure, because of the necessary effect which this has upon the nutrition and the consequent resistance of the part. Only such limitation of function should be allowed as is necessary to control the symptoms in the given case, and aside from this, use should be allowed, in order that the circulation and the nutrition may be interfered with as little as possible. By so doing not only is the local resistance increased, but the healing, even in the severe cases, takes place much more rapidly than can be expected where the

extent of the limitation of the function has made all of the processes sluggish.

In limiting the motion the position of the part should carefully be borne in mind with reference to the balancing of the various groups of muscles, recognizing this as nature's protection against deformity, and that if this can be established the muscle spasm, which results from over stimulation of the muscle without the normal antagonizing power, will disappear. At the same time the position with reference to the ultimate function, in case anchylosis should take place, should be considered.

In the knee the most favorable position to accomplish both of these is with the joint flexed about five degrees. In this position the flexor and extensor muscles properly antagonize or balance each other, so that the muscle spasm which is so noticeable a feature during the active stage of the disease, if the joint is flexed, ceases entirely. This position, in case anchylosis takes place, is also the most favorable for practical use.

In the hip the best position is with the thigh flexed about twenty degrees, abducted fifteen to twenty degrees, and outwardly rotated about ten degrees. In this position the head of the femur rests most easily in the acetabulum and the various muscle groups are balanced so that the element of spasm is largely eliminated. This position is not only the most favorable during the acute stage of the disease, but it is also the most favorable in case the disease is so extensive that anchylosis is the final result. In this position the flexion and abduction act as flexion in sitting, while in walking the abduction with the outward rotation make it possible to preserve the upright position and obviate the rolling gait seen wherever the leg is the least adducted. In standing the flexion is overcome by the increased flexibility of the lumbar spine, while the abduction corrects in part at least any shortening which may have taken place.

In the spine the most favorable position is that of considerable hyperextension. This overcomes the great disadvantage in which the posterior muscles act when the body is flexed (the usual deformity), at the same time lessening the pressure at the seat of the disease, with the consequent benefit to the general health which must come from the fact that in hyperextension the thorax is expanded, giving greater respiratory movement.

In the ankle the best position is with the foot at right angles with the leg, in which position the spasm of the gastrocnemius, which is so

marked when the foot is dorsally extended, is entirely overcome, and in case of anchylosis this position is also the most favorable for function.

In the other joints the same principles apply, but as these joints are less frequently affected than those already mentioned, it does not seem essential that they should be specially considered. The joint should be protected during the active stage of the disease, and the position during protection chosen with reference to overcoming the muscle spasm by balancing the antagonizing muscle groups, this at the same time being the best position for anchylosis in case the disease should be so marked as to make this result necessary.

At times even under the most favorable conditions the joint lesion does not improve under conservative measures which should always be thoroughly tried first, and something more radical becomes necessary. This may also be considered advisable, at times, when in some exposed part the lesion is shown so clearly to be localized and easy to reach that even though the process might heal under conservative means, it is nevertheless frequently wiser to extirpate the area of disease.

The special operation which is to be performed in the given case must necessarily depend upon the part affected and the severity of the disease. If it be located in the joints of the extremities, and there is not only great bone destruction, but extensive involvement of the soft parts, with the general condition such that it is evident the resistance to the extension of the disease to other parts is nearly reached, amputation or entire removal of the affected part may be demanded. In any such case, however, if the environment previous to this consideration of treatment has not been of the best, at least a short period of trial under the most favorable general and local conditions should be urged, as under such conditions even seemingly hopeless cases at times improve very markedly. If this be the case, while operation may still be needed, a less mutilating operation than amputation may be sufficient to accomplish the desired result.

Excision of a localized area of disease is occasionally possible, but usually, because the involvement is more general, more extensive operations such as excision of the entire joint are demanded. In the knee this is most satisfactorily carried out, while in the hip it is less satisfactory because it is not often possible to remove all of the diseased bone. In the ankle the complexity of the joint, with the frequent extension of the disease to many of the tarsal joints, makes extirpation of the disease difficult if not impossible. It is to be borne in mind, however, even in

such a case that although all of the disease cannot be removed the condition is not necessarily hopeless, as not infrequently if a large part of the disease is removed nature is able to take care of the rest, and healing promptly takes place.

In any case, however, whether the disease be located in the knee, hip, or any other joint, before an operation is performed the part should be put at rest for sufficient time for the process to quiet down, realizing that by so doing the dangers of absorption with extension of the disease to other parts are very much lessened. To still further lessen this danger, before the wound is closed the entire operating field, both bone and soft parts, should be generously wiped out with the tincture of iodine or pure carbolic acid. If the latter is used alcohol should be used immediately ofter the application of the acid. Personally the iodine is my preference, and after its use the wound should be loosely closed, not attempting to establish drainage other than to allow the escape of the excess of the exudate which would follow the operation. It is always well to try for a rapid closure of the wounds, as by so doing the danger of secondary infections, other than tubercular, is very much lessened.

Another point which is of importance in the treatment of such conditions, and this chiefly as a preventive measure, is the correction of deformities which may have resulted before our responsibility in the treatment of the case began.

A flexed or adducted hip, a flexed knee, an extended foot, all are deformities which result in strain to the part during use, which in the majority of cases, if continued, will result in the lighting up of the original disease. This being the case, even though there may be no evidence of active disease at the time of the examination, if deformity be present so that the joint is strained in use, operation for the correction of this should be advised. If the active disease is still present, conservative measures, such as traction, or protection, should be advised, but if the deformity is seen in the healed process operations such as the sub-trochanteric or transtrochanteric osteotomy for the hip deformities, the supra-condyloid osteotomy, or wedge shaped re-section, for the knee deformities, and the removal of the astragalus or osteotomies for the ankle deformities. All of these are of importance, and should be advised under such conditions for the purpose of prevention of the recurrence of the original disease.

Of the special features more or less common to all forms of bone and

joint tuberculosis, the abscess is probably the most common. In dealing with this it is to be remembered that such an abscess is formed by the softening down of the center of the tubercular mass; that the wall, or periphery, of the mass is composed largely of tubercles, and that the increase in the size of the abscess is due to the extension of the disease at this periphery. Such an abscess, if uncontaminated, contains no other organism than the tubercle bacillus, and is not associated with rise of temperature or other symptoms indicative of general systematic disorder. Its presence is usually made known, unless it comes to the surface where it is readily seen, not by any special general symptoms, but by interfering mechanically with the function of the part. The joint capsule may be made more tense, a muscle (such as the psoas) may be irritated or pressed upon with resulting contraction, a nerve, such as the vagus, in the posterior mediastinal abscess, may be irritated and cause serious cardiac symptoms, or an organ, the trachea or bronchus, from a retro-pharyngeal or mediastinal abscess, or the abdominal viscera from the large abdominal abscesses, may be pressed upon and their function interfered with. All these and many others of similar nature are conditions often seen, and from the point of view of treatment such considerations assume importance. The mere presence of an abscess, provided it is not interfering with the function of some special part, and provided that it is not part of a general infection, as would be shown by the elevation of the temperature and the general condition, is of very little importance as long as it is closed. If the abscess could be entirely removed and the primary focus removed at the same time, some procedure which had for its purpose this end would strongly be desired, but when it is remembered that in many cases, in fact in most of the cases, the entire removal of the primary focus is not possible, free drainage of the abscess is not to be desired, since it opens a mode of fresh tubercular infection along the wound and furnishes a mode of entrance for other organisms which are as much to be feared as the primary disease. Many of the deaths which occur in cases of this sort are due to a general septicaemia resulting from this secondary infection and are only indirectly due to the tuberculosis. For this reason unless there is hope of the entire removal of the disease the abscess should be ignored, until it has come well to the surface or is causing some of the undesirable symptoms mentioned above. In any case, the danger of the secondary infections and the practical impossibility of keeping a discharging sinus clean should always be borne in

mind. In children the resistance to the mixed infections is undoubtedly greater than with adults, but even with them the utmost care should be taken, both at the time of the operation and later to keep the process purely a tubercular one.

If, for the reasons given above, drainage of the abscess is desired, it is wiser, wherever possible, to aspirate for the purpose of removing the excess of the fluid, not expecting to remove all of the disease, which is impossible except in rare instances. This aspiration will probably have to be repeated several times, the intervals depending upon the rapidity of the refilling of the cavity. If, for any reason, the aspiration is not successful, small punctured incisions, one or more, would be the most desirable procedure. In any case, if the abscess is generally infected, free incision should be made, the pus evacuated, and the cavity wiped out. The tissue should not be torn or mutilated more than is necessary, and the curette should not be used, since all such procedures open fresh points for absorption. In order to lessen the danger of this as well as to destroy any free tubercular material, after the pus has been evacuated the entire cavity as well as the fresh edges of the wound should be thoroughly wiped with the tincture of iodine or with pure carbolic acid.

Following this the wound should be loosely closed, leaving a small wick extending into the abscess cavity, which should be removed in from three to four days. After this the wound should be encouraged to heal, knowing that the abscess will undoubtedly refill, and at some time later require further attention. Even should this be repeated several times it is better than if a long continued discharging sinus is allowed, because of the lessened danger of secondary infection.

Such, gentlemen, are the essential features which should be the basis of all treatment for patients afflicted with bone or joint tuberculosis. No one feature is alone of value, but in connection with the others which have been enumerated it assumes its proper proportion, and if the treatment be consistently carried out along such lines, not only will the results be better, but the great dread which this disease inspires, both in the minds of the profession as well as the laity, will give way to the more reasonable consideration such as is accorded to other controllable diseases.

DISCUSSION ON DR. GOLDTHWAIT'S PAPER

Dr. Wisner R. Townsend, New York: Owing to the great advances that have been made of late years in the knowledge of the etiology and pathology of the diseases affecting the bones and joints, the question of the diagnosis of tuberculosis is deserving of especial consideration at the present time.

Until recently all chronic affections of the bones and joints with few exceptions, occurring in childhood or early adolescence were considered to be due to tuberculosis. Arthritis, caused by infection from pneumococcus, streptococcus, staphylococcus, gonococcus, colon and typhoid bacilli and micro-organisms of other diseases were classed as cases of chronic joint disease and most of these were supposed to be due to tuberculosis. The arthropathies occurring in nervous diseases, except those of tabes, were often erroneously included with the above and the same was true of the lesions of scurvy and of the infectious processes occurring after measles and scarlet fever. Rheumatism and tuberculosis were the two diseases that were supposed to cause most of the diseases of the bones and joints except with those who saw in syphilis, acquired or hereditary, a cause for a large majority of the cases. Even coxa vara and fracture of the neck of the femur in children were classed as hip disease.

To-day many of these conditions can be easily and positively made out, and the profession is keenly alive to the necessity for greater proficiency in diagnosis, but how is one to say at the onset of many cases whether the lesion is a tuberculosis or a chronic osteomyelitis or some form of infectious arthritis. On this point the profession needs more light.

The addition of the X-ray as an aid to diagnosis has already proved of great value and its use should be encouraged. In many instances, the findings will be of positive importance and enable one to decide the exact focus and whether it is located in the bone or the soft parts, but with our present knowledge, by the X-ray alone, we can determine very little as to the etiology of the joint affection. Too much attention must not be paid to the presence or absence of tuberculosis in the family history. The tuberculin tests and other tests should be thoroughly tried in surgical tuberculosis, so that we may ascertain their real value as aids to diagnosis. In doubtful cases a diagnosis by exclusion must be carefully made, but in most instances positive data

at the onset as to whether a lesion is due to tuberculosis is not often obtained in joint and bone lesions and this leads naturally to the question whether the prognosis has not been in the past made too favorable, when statistics were shown, in which the percentage of cures was high, and in many instances the duration of treatment comparatively short.

Looking back over hospital and private cases, it is evident that many supposed to be due to tuberculosis were due to some other cause and the diagnosis of joint and bone tuberculosis is not made as frequently to-day in large surgical clinics as it was ten or fifteen years ago. But we must not conclude from this fact that there are less cases; the true conclusion is that a greater knowledge enables one to more clearly differentiate the different forms of joint and bone disease.

If the facts just stated are correct, one must conclude that tuberculosis of the bones and joints are most serious diseased conditions and need the greatest care in treatment, both constitutional and local. The outdoor life, supplemented by surgical and orthopedic treatment is justly meeting with great favor. The general health is thereby improved and the ability to withstand the depressing effects of the local disease, if it is ever really local, is greatly aided. Body weight tends to increase, nutrition is improved and the complications of abscess and sinus yield more readily to proper treatment. There is no reason why mild cases of tuberculosis of the bones and joints should not entirely recover and it may well be asked if in many instances such cases would not be improved by early operation where the focus is clearly made out by means of radiography. If erosion, arthrotomy or arthrectomy are properly performed, joint function is not necessarily lost and the disease may be arrested in the beginning. Most operations are performed in tuberculosis when sepsis is already a serious factor and it is sepsis that we should guard against. Mechanical treatment should be employed in the beginning, but it should not be continued blindly for indefinite periods, especially after sepsis has occurred. In the spine mechanical treatment will necessarily be the favorite and best form of caring for such cases, but in the other joints this does not necessarily follow in all cases. Apparatus of varying types should be usel in such a manner that function may be restored when possible, but if there should be loss of function the apparatus must be so adjusted if ankylosis occurs it will be in such position that the least possible deformity and disability will result. Traction in the joints of the lower extremity is advisable and at the hip; the writer must take exception

to the statement that the limb should be abducted and flexed to about 25° each and rotated out. Very slight flexion and abduction may be permitted but not to the extent of 25°. Mechanical treatment will suffice in the majority of cases, but a certain percentage require surgical operations and of these a small number will require excision. Surgeons of to-day do not excise as freely as was formerly done and at the knee it should never be done before the sixteenth year, as the interference with the growth of the limb is a serious matter and in childhood it is rarely necessary. In adult life it is an operation of value and possibly the suggestion of Murphy of interposing fatty tissue between the divided ends may permit one in time to secure motion in cases that formerly could only terminate in anchylosis. It may also enable one to do atypical excisions and yet remove the disease. Excision for fear of relapse is not indicated if one is to judge by the infrequency of relapse in really cured cases. Amputation may be necessary in rare instances, but if it is, it is nearly always for sepsis or in neglected cases where the previous treatment has been imperfectly carried out. The details as to what form of appliances to use in given cases and the best manner of treating abscesses or sinuses must be omitted and the same is true of various forms of treatment, such as by passive congestion advocated by Biers, as this discussion refers to general principles only and not to details.

Dr. A. T. Cabot, Boston: In the forms of tuberculosis that come to the surgeon the infective process is a slowly progressive one against which the tissues strive to protect themselves with varying degrees of success in different parts of the body and in different persons.

The means by which this protection is obtained is mainly by the formation of a wall of connective tissue about the tuberculous mass, shutting it in and preventing its spread. When this protective effort is of sufficient power to successfully resist the tuberculosis, it does so by thoroughly encapsulating the process, and, in that case, the masses of bacilli, cells and the waste products of the cells are compressed within a slowly contracting capsule and undergo cheesy degeneration until, finally, they may even be changed to chalky concretions.

The success of this limiting effort on the part of the tissues depends in great degree upon the vigor of the individual, so that a decided improvement in the surroundings and habits of the patient may bring about a cessation of the progress of the disease.

The local outbreak of tuberculosis that brings a patient to the sur-

geon may occasionally be primary and the lesion may be located at and about the point of entry of the bacilli. Ulcerations of the cutaneous or mucous surfaces are or may be of this class, and we may, I think, properly include here also those cases in which the disease is confined to the lymphatic glands immediately adjacent. Tuberculous masses in the bowel wall and localized tuberculosis of the mesenteric glands are familiar instances of this condition.

It is probable that tuberculous glands in the neck are often to be counted in this same class, being due to bacilli that have found their way through the mucous membrane of the mouth or fauces without causing visible lesions of these surfaces.

Professor Theobald Smith has called my attention to the fact that it is probable that a considerable proportion of these cases of glandular tuberculosis in connection with the fauces and intestinal tract are instances of infection with bovine tuberculosis; and he suggests that this may help to explain the comparative sluggishness of the process and its tendency to remain localized and not to set up a general tuberculous infection of the system.

This seems to me a highly interesting suggestion in regard to which we shall anxiously wait for more light from Professor Smith's further investigations.

Surgical tuberculosis is, however, in the vast majority of cases a process secondary to some deeper infection.

The primary focus is usually in the lymphatic system connected either with the respiratory or the digestive organs. Commonly this primary focus is well encapsulated and quiescent so that if the active and more serious local process is removed or brought to a standstill the patient's return to health is gratifying and often long enduring.

We are justified, then, in regarding these lesions when they occur singly as essentially primary and it is our habit to proceed to their treatment with a corresponding measure of hopefulness.

Our treatment will be both general and local, hygienic and operative. For convenience we will first consider the question of operative treatment although the general hygienic treatment is of even greater importance.

Operative Treatment.—When the active, local process is accessible, it is usual to make as thorough a removal of it as possible. It is important then to have a clear conception as to the degree of thoroughness that we can obtain in the removal of these local tuberculoses.

Occasionally a localized tuberculosis can be entirely dissected out with a considerable margin of healthy tissue around it. When this can be done without bringing the tuberculous parts in contact with the healthy, that will constitute a thorough removal.

It is important in removing tuberculous glands or other suppurating foci, to preserve the capsule intact, and not to allow the pus to escape and infect the fresh wound.

In operations upon tuberculous lesions of bone it is rarely possible to make a thorough removal and the parts about are almost invariably infected during the operation. Fortunately the tissues are able to dispose of a moderate dose of the poison, so that a removal that is approximately thorough answers almost as well as if it were absolutely so. It is probable that microscopical amounts of tuberculous material which are left behind are actually destroyed and removed by the tissues. Larger portions are encapsulated and it is interesting to note that these operations, which are followed by thoroughly satisfactory healing, often leave behind them little foci of tuberculous material buried in the cicatricial tissue.

We must accept then the position that in these cases our operation is usually incomplete and that nature must afterwards do much to accomplish the cure. Although we may depend upon natural forces to do much to assist us in this way it is evidently important that the removal of tuberculous material shall be as thorough as it can possibly be made. All infected glands should be hunted up and removed, sinuses should be thoroughly curetted, or, when possible, dissected out.

In bony tuberculosis the primary focus should always be sought for and removed with a considerable surrounding portion of healthy bone. Dr. E. H. Nichols' researches have shown that the disease extends in the bone about half an inch beyond a point where it can be seen by the naked eye. Where possible, therefore, a considerable surrounding portion of healthy bone should be removed with it. This is usually accomplished in resections of the knee and elbow and also in amputations done for the removal of limbs hopelessly disorganized by tuberculosis.

When the disease attacks bones in their continuity, where it is impossible to remove considerable portions without seriously interfering with the functions of the part, surgeons usually resort to curetting for the removal of the diseased portions.

As these portions are softened it is usual to depend on the consistency for information as to whether the sound bone has been reached.

The researches of Nichols, however, above cited, show that this is an unsafe guide and that little islands of tuberculous tissue lie buried in the seemingly sound bone around. It is not surprising, then, that after such an operation the surface frequently remains in a carious condition. The obvious lesson to be drawn is that chisel and gouge should be used more freely in the removal of the surrounding hard bone.

In the carpus and tarsus tuberculosis is almost certain to recur after a partial operation which leaves any part of a bone which has shown the disease. This unfavorable behavior is doubtless due in part to the comparatively ill-nourished condition of these bones.

Surrounded as they are by cartilaginous joint-surfaces, their periosteal envelope, through which they receive nourishment, is comparatively scanty. It is well, therefore, to wholly remove any of these bones that are diseased.

The os calcis forms an exception to this rule, being well surrounded by periosteum; and in practice it is found that when the joint surface is affected it may be removed, leaving the lower, better nourished portions of the bone with a reasonable hope that they will remain free from the disease. It is fortunate that this is so, for the usefulness of the foot depends much on the preservation of the heel.

In the wrist the functional result after a removal of many of the small bones is often not good, as the tendons to the fingers become adherent, but in the ankle these operations when undertaken in the young give excellent results.

Management of Tuberculous Abscesses.—If the abscess is accessible, so that it can be widely opened and thoroughly curetted, this treatment should be adopted. When the abscess is of bony origin the sinus leading from it to the focus of the disease should be sought out. After appropriate treatment of the bone it will often be found that a short direct drain can be established to the surface and that then a large part of the abscess can be closed by deep buried stitches.

The thoroughly curetted walls of such a cavity will often cohere in a most satisfactory way and thus the area of suppuration will be at once reduced to a direct sinus to the bony focus.

Many abscesses are so situated that they cannot be thus thoroughly treated. Psoas and iliac abscesses are familiar examples of this class.

In such cases where the operation cannot be thorough it is usually well to evacuate the pus with as little disturbance of the parts as possible; for if a partial curetting is done the denuded parts are quickly reinfected and this new invasion of the freshly wounded tissue is accompanied by a hectic fever, so that the patient is worse off than before. These cases, too, are of such long duration and the discharge is so profuse that they sooner or later become infected with other pus organisms and the difficulties of the case are thus greatly increased.

It is wiser, then, when the deeper parts of the abscess cannot be reached, to make a small opening and let the pus slowly drain away. The gradual contraction of the walls of the abscess, by reason of the cicatricial tissue surrounding it and also by reason of the intra-abdominal pressure when the abscess is within that cavity, finally reduces the condition to a sinus communicating with the central focus of disease and in favorable surroundings even this may finally close.

Sometimes, in very large abscesses, repeated aspirations may be of service in reducing the size of the cavity before it is finally opened.

Tuberculous empyema introduces a new problem in that the rigid wall cannot contract down and close the cavity. It is exactly in these cases that extensive thoracoplastic operations are called for and excellent results will often reward a patient and persistent effort to obliterate the cavity. The walls must be brought together before the still tuberculous parts can be surrounded, walled in and encapsulated.

Tuberculous peritonitis has great interest for surgeons and with its etiology, pathology and treatment furnishes matter for a chapter by itself. It is perhaps the most striking example of a widely spread tuberculous process in which nature with but slight assistance often works a cure. Even when the tuberculous Fallopian tubes, appendix or mesenteric glands in which the disease may have started have been removed, it would seem hopeless to expect the wide infection of the intricate peritoneal surface to cease. The case is even more striking when no primary focus is found and when the operator contents himself with evacuation of fluid and yet in these cases brilliant results and lasting cures are common.

The removal of an abundant culture fluid and the collapse of the distended peritoneal sac so that the tissues are enabled to surround and encapsulate the tubercles give the natural forces a chance to work to advantage. Doubtless, too, the increased congestion induced by

the exposure and handling of the abdominal contents assists the tissues in their resistance to the tuberculous process.

Genito-urinary Tuberculosis.—Here the disease usually starts in the epididymes, the Fallopian tubes or in the kidneys. Tuberculosis starting in the Fallopian tubes is usually not discovered until after it has set up a tuberculous peritonitis and in such cases the operation should not be considered complete until the original focus in the tube has been removed.

In tuberculosis of an epididymis an early extension through the vas to the seminal vesicle and prostate is to be expected. Usually this extension has already taken place before the lesion in the testis makes itself troublesome. As a rule, therefore, castration for tuberculosis in or about the testicle is not a radical operation and leaves the disease firmly entrenched in the deeper parts.

Even under these conditions, however, a painful suppurating or extensively disorganized testicle should be removed on the principle that by greatly diminishing the area of tuberculosis we may reduce it to an amount that can be successfully resisted by the *vis medicatrix Naturæ.*

It is often a difficult problem to decide in these cases when to interfere and when to let alone. Much will depend on our accurate appreciation of the extent and distribution of the disease.

When the tuberculosis starts in the kidney it soon extends down the ureter to the bladder. Renal tuberculosis is usually unilateral at the start and even after the bladder is affected the disease is slow to creep up the sound ureter against the flow of urine. Fortunately also the symptoms of tuberculosis of the kidney are pronounced and so uncomfortable that the patients seek advice measureably early. Modern methods of investigation enable us to surely discover which kidney is affected and also to learn the functional activity of the other kidney. We are then enabled to remove the diseased organ while the tuberculosis is practically confined to it, and after the abundant supply of bacilli in the urine is thus cut off the vesical lesions are usually amenable to treatment and the restoration to health may be satisfactory and lasting.

Effect of Age upon Operative Results.—Young people do so much better than their elders after operations for tuberculosis that our expectation of success will be in inverse ratio to the age; and the older the patient the worse will be the prognosis.

This will often greatly affect our choice of operation. For instance, in a child we proceed to the removal of an extensively diseased tarsus with good hope of recovery and a fairly useful foot. In an older person such an operation might be extremely unwise and the patient might succumb to the long suppuration following it when an amputation, which thoroughly removed the disease and allowed the patient to quickly leave the bed, would have accomplished a quick recovery.

After-treatment.—In cases in which during the dissection of a tuberculous process the wound has been in contact with the diseased tissues or has been contaminated by the escaping pus, it is important to free the tissue of infective material as far as possible before closing the wound. This may be done by washing the wound with an aseptic or antiseptic solution. Tincture of iodine is one of the most efficient of these and I have used it in this way for years. The whole surface of the wound should be thoroughly rubbed with it. Healing is not apparently interfered with by such an application.

The local treatment should further consist in giving the parts absolute rest and, if possible, applying gentle, even pressure over the whole seat of disease. In some cases, when removal has been very thorough, a complete closure of the wound may be adopted; and some cases of resection will do well when the wound is wholly closed or when only a dependent opening is left for drainage for a short time. In other cases, in which owing to the difficulties of the operation, removal of the tuberculous parts is less complete, this opening is made not only to provide drainage, but to afford access to the parts for subsequent treatment, with the hope of assisting the tissues to throw off the tuberculous process. This may be done by leaving the bony cavity widely open and packed with gauze.

We have in iodoform a substance which has, in a measure, a specific effect upon tuberculous processes. It seems to act by stimulating the tissues to an adequate resistance to the tuberculous material left after operation. In a case of an extensive cavity iodoform is generally applied in the form of iodoform gauze or by the means of setons, which are very useful in the ankle- and wrist-joints. When we have considerable sinuses which it is difficult to reach in the application of gauze, iodoform oil forms a good means of applying the drug to the deeper parts and often excellent results are obtained by its use.

Even after healing has been accomplished, it is usually important in cases of joint tuberculosis to protect the parts from motion for a con-

siderable time by the application of apparatus, as, if motion is allowed, the disease is apt to reappear.

The Destruction of Infective Discharges.—Before leaving the question of after treatment it is well to remind ourselves of our duty to the community as well as to our patients and to emphasize the importance of immediate and thorough destruction of all discharges coming from tuberculous ulcerations.

Dressings should be at once burned and clothes soiled with pus should be soaked in an antiseptic solution or boiled before they go into the family wash.

A case in which these precautions are neglected acts as a focus of infection and spreads the disease through the neighborhood, whereas a reasonable amount of care in disposing of the bacilli while they are still moist prevents their being disseminated in the form of dust, and thus prevents the spread of infection. A patient thus cared for ceases to be a menace to the community.

As bacilli can only be reproduced within living bodies it is our obvious duty to cut off the sources of supply wherever we can. Surgeons who have successfully coped with so many other microorganisms ought never to neglect so obvious a precaution.

This brief consideration of some of the more common forms of surgical tuberculosis in which operation for the removal or relief of the tubercular process may be undertaken shows us that a complete cure by operative measures alone can almost never be accomplished. With but few exceptions, the most thorough removal leaves behind some residue of tuberculous material, either in the operative field or in some distant gland or other organ.

It is plain, then, that much remains to be done even after all visible lesions have been eradicated.

General Hygienic Treatment.—Recognizing the effort which nature makes to resist the disease, it is manifestly important to render all the aid we can in the direction of increasing the strength of the patient and the vigor of the tissues. Our efforts should be directed first to improving the habits and surroundings of the patient, secondly, to bettering his nutrition and, thirdly, to giving complete rest to the diseased parts.

The hygienic treatment should be the same as that provided for cases of pulmonary tuberculosis.

Life in the open air is as important for these patients as for those

suffering with phthisis. It is surprising what improvement may be wrought by substituting a really out of door life for what seemed a sensible healthy life under ordinary conditions. I have known a sinus connected with a tuberculous hip which had continued to discharge for years under the best obtainable conditions that entirely and permanently closed during a ten days' sea voyage. Also a tuberculosis of the prostate which was so painful as to be disabling and which during a six weeks' camping trip in the woods was so improved that the patient, a physician doing a large country practice, was able to resume his work on his return. Subsequently suppurative foci appeared in the epididymes; but these did not disable him and he is now, twelve years later, doing his full work in seemingly good health.

The importance of an out of door life for the cure of tuberculosis is now so well recognized that it is perhaps not necessary to dilate upon it here.

It is obviously a consideration which should never be absent from the surgeon's mind in planning his treatment for each case. The advantages to be gained by an operation have to be weighed against the disadvantages of the depression of strength which the operative procedure will entail and of the loss of fresh air and good nutrition which confinement in bed will involve. It sometimes happens that an attempt to do a thorough and radical operation so weakens the patient that before he leaves his bed the tuberculosis has obtained a fresh start and has invaded more territory than was occupied before the interference. The question of when to operate and when not is one requiring then experience, trained judgment and careful consideration in each case, and that surgeon will best succeed who obtains for his patients a minimum of surgical confinement with a maximum of open air and sunshine.

It is appropriate here also to call attention to the fact that when a case of cured tuberculosis is assailed by an acute febrile disease the tuberculous process is likely to reappear. I have repeatedly seen instances of such a relapse in children attacked by scarlatina. It is important to have this in mind, to treat such patients with due regard to their tuberculous tendencies and to make especial effort to procure for them the benefits of open air and sun even during the height of the intercurrent disease.

Doubtless a large part of the benefit of an out of door life is due to the stimulation of tissue changes and to the amendment of the diges-

tion. These beneficial results are greatly aided by proper exercise and one great benefit derived from orthopædic apparatus for fixing painful tuberculous joints is that the patients are thus enabled to get about and to follow enjoyable pursuits in the open air.

The selection of proper food has been so thoroughly discussed that I do not propose to open that question here, but it must be remembered that in sending a patient into the country this should always be thought of and provided. For good cooking does not always abound where the air is purest; and a tuberculous patient will not get benefit from a camping trip if he is roughing it on poor food and irregular hours.

Rest to the diseased parts should always be provided. This maxim is universally recognized in the tuberculosis of joints and the triumphs of orthopædic apparatus in the fixation of joints and in supporting diseased spines hardly need mention in this general review of the subject. It is not, however, generally appreciated that the healing of tuberculous soft parts may be greatly assisted by protecting them from movement. I have seen obstinate sinuses in the neck which, after resisting all efforts at cure, have quickly closed on fixing the head by a stiff pasteboard collar.

To recapitulate, then, the surgeon's *first* duty is to put his patient in surroundings of air and sun, such as have abundantly proved their efficacy in the cure of all forms of tuberculosis.

Secondly, he must provide in every possible way for the fullest nutrition.

Thirdly, he must give the diseased parts rest by apparatus which interferes as little as may be with the motion and exercise of the unaffected parts of the body.

Fourthly, after these fundamental needs have been provided for he may proceed by operative measures to remove or alleviate the local condition as fully as lies in his power.

Fifthly, it is his duty to protect protect the community from contagion, and to this end he must teach his patients to destroy all discharges from tuberculous processes.

Sixthly, he should impress his recovered patients with the importance of so arranging their business or occupations that they may pass a large part of their time in the open air and so guard against a recurrence of the disease.

Dr. B. E. McKenzie, Toronto: The writer of the paper has covered the ground, in my opinion, very thoroughly and there is very little that

I would feel disposed to take exception to, but I may be permitted to emphasize some points and perhaps to criticise some others.

I am glad the writer laid emphasis upon the importance of diagnosis; but I have come to regard our diagnosis as a rather certain factor and would not be inclined to attach as much doubt to it as Dr. Townsend has done. The importance of making the diagnosis early, however, can not be too much magnified.

As to the etiology of the disease we have to regard three elements: heredity, lowered vitality, and infection. Now simply because the bacillus of tuberculosis was discovered in 1882 by Koch is no reason why the consideration of heredity as a factor should become obsolete; on the other hand, it is an important element in the consideration of this disease from the standpoint of prognosis.

As to lowered vitality, it is very important that children should be guarded against the zymotic diseases. A child who has had whooping cough, or measles, is placed in a condition, because of lowered vitality, where it is more liable to contract the disease.

As to treatment, a good deal has been said about rest; now I have come to feel about the matter that rest, especially as considered by the orthopedic surgeons, has been rather overdone. It depends largely upon how the rest is to be secured. As to the orthopedic braces as ordinarily used in hip disease and disease of the spine, they are antiquated instruments and out of date in the acute stages. I do not think any one can make a brace that will keep the spine even fairly well at rest; one that will enable us to have a fair degree of rest while at the same time allowing certain constitutional remedies to be used.

I regard the Bradford Frame, made with double canvas, and gas pipe, as an excellent thing, employed to keep the patient constantly recumbent. The great advantage is that the child can be kept out of doors and at the same time have the diseased parts at rest. Six or seven years ago, in the Toronto Orthopedic Hospital, in the midst of winter, a man with tuberculosis of the spine contracted diphtheria and we sent word to the Hospital for Contagious Diseases to take care of him, but they said they could not do so because of the surgical treatment needed. So we had to pitch a tent on the campus and put another patient there to nurse him. In forty-eight hours it took twice as much to feed these men as before. We have been impressed with the striking results of keeping these patients out of doors. We put them out during the day and allow the back to be exposed to the sun

until it is tanned or blistered; they recover from the immediate effects in a few days and are put out again. I have never seen such good results as are obtained in that way. The patients live out of doors during the entire twenty-four hours, having only the protection of a canvas tent when absolutely necessary.

As to abscesses, I think they may be left alone very largely. With regard to the position of the knee, I must take exception to the method advocated by the writer of the paper, that it be kept fully extended. I do not think that method right during treatment, nor during recovery. I think there should be a flexion of from 5 to 15 degrees.

I have found the injection of iodoform emulsion into tuberculous joints and into abscess cavities a practice attended with signal benefit—a ten per cent. emulsion of iodoform in glycerine. Very frequently large abscesses treated in this manner disappear without opening—a much larger proportion of them than would do so if not so treated.

Dr. Joseph C. Bloodgood, Baltimore: The paramount object of treatment is the cure of the disease with complete function of the joint. The latter is the most difficult to attain.

The three factors in treatment are: local rest of the diseased part, surgical intervention in selected cases, and the general hygienic treatment of the patient.

To accomplish a cure with restoration of joint function depends more upon early recognition of the disease than any other factor. The public, therefore, must be educated to the early symptoms which suggest a lesion of the bone or joint.

When the general practitioner sees these patients in this earlier stage he must be keen in the differential diagnosis.

A course of treatment appropriate for tuberculosis may be inappropriate or harmful for other lesions.

The tuberculin test and the X-ray should be considered essential in the diagnosis.

Both in children and adults the diagnosis of inflammatory rheumatism is too often incorrectly made.

The possibility of a gonorrhœal arthritis, of pyogenic osteomyelitis, a bone tumor, syphilis, and the early stage of arthritis deformans (acute or chronic non-tuberculous arthritis) should always be carefully considered.

The paramount factor at the outset of treatment is diagnosis. One reaches the conclusion as to a diagnosis of tuberculosis in various ways,

according to the stage of the disease. The tuberculin test, the X-ray and other factors which allow an exclusion of other diseases must all be employed.

If there be any doubt as to the nature of the lesion and if the symptom-complex suggest the possibility of any of those lesions for which early surgical intervention is best suited, an exploratory incision is justifiable.

In many instances precious time is lost because of an incorrect diagnosis of a form of tuberculosis in which non-operative treatment is indicated.

The more one inclines to the non-operative treatment of tuberculosis the more exact should be the methods of diagnosis.

I agree with Dr. Goldthwait that especially in children and in the early stages of the tuberculous lesion equally good results are obtained by non-operative treatment, and I agree with him that the fixation of the affected joint should be modified towards allowing some motion, varying in different stages of the disease.

In all forms of surgical tuberculosis the open air or hygienic treatment is usually incomplete.

In the local treatment the time is usually made too short. It is most important to impress the public and the general profession that both local and general treatment should be continued months and perhaps years after all symptoms have disappeared.

These patients, whether children or adults, should be instructed in a mode of life which will protect them from future recurrences. The affected limb should always be considered one in need of protection, and the patient should be cautioned to continue as far as possible the hygienic life led during the active stage of the disease.

The indications for surgical intervention for tuberculosis of the bones and joints are manifold. They vary with the age of the patient, the duration of the disease, the pathological extent of the local lesion and the joint involved.

One cannot read Bier's numerous communications and recent reports by others on the employment of hyperemia without the conclusion that this method has not been given proper consideration in this country.

A long personal experience, and the reading of the literature, makes me skeptical as to the value of the various joint injections, for example, iodoform.

In children experience contraindicates operation (as a rule) in all stages.

If the local lesion is progressing and one feels that operative intervention promises a restriction of the disease and an ultimate better function of the joint, there should be no delay.

In adults the opposite is true. If the indications suggest that in the ultimate cure the joint will be ankylosed, time valuable to the individual is saved by excision of the joint. The functional results of such an excision in the ankle, wrist, elbow and shoulder are so excellent and the functional results, in my experience, of the non-operative treatment are so poor, that I am inclined to early excision in the majority of cases.

When there is an abscess my experience indicates that better results are obtained by the direct attack of the bone focus than by any treatment of the abscess itself.

If the X-ray shows a large tuberculous focus in children or adults, better results are obtained by operative intervention. These cases are infrequent.

If the clinical history indicates a rupture of a bone focus into a joint previously unaffected, immediate operation is indicated. The joint should be washed out, and the bone focus exposed. I have had such cases with perfect restoration of function.

If one can make a diagnosis of primary tuberculous synovitis, I believe arthrotomy and irrigation are indicated, especially in the knee-joint. We are too satisfied with a cure and impaired function.

Dr. William S. Baer, Baltimore: I am sure we have all been very much interested to hear these papers and the discussion which has followed.

In regard to the treatment of tuberculosis I think we all heartily agree that the less operative work that is done the better, particularly in the case of children, but there seems to me to be a certain class of cases, particularly in those above fifteen years, in which we can recognize a very early tuberculous focus and which should be attacked radically. By means of the X-ray we can get a pretty good idea as to the dimensions of the focus, and then by means of the tuberculin reaction, particularly considered as to local reaction, we can get a pretty definite idea as to the condition. In that class it seems to me better to eradicate the small focus and save time instead of having a prolonged course of treatment.

I was much interested to hear Dr. Goldthwait's remarks about considering it as any other affection of the joint and his suggestion that

probably we were keeping these joints at rest too long. The joint needs a certain amount of motion. Within certain limits we should allow the normal movements. If we keep it immobilized too long we do so to the detriment of the patient. All other joints, too, should be allowed to be free and massage should be employed judiciously after the acute stage of the disease has passed.

Dr. Alexander H. Ferguson, Chicago: I have been very much pleased to hear this discussion and have only a few words to add. I should just like to say a word as to the iodoform injections. I commenced its use when the practice was first started and continue it up to today in a modified form. In cases of acute synovitis of the hip or other joints, after the joint has been explored I believe washing out and leaving iodoform inside the joint produces what we want for the cure of the disease. In a number of instances only a few such treatments have resulted in a symptomatic cure. The iodoform injection causes a marked determination of blood to the part, just what is produced by the Beard treatment, and at the same time the iodoform is germicidal, so that we have two advantages in the iodoform treatment. When there is an old chronic condition with necrosis I open down and remove the pathological condition. Recently I have been trying the Moorhoef treatment. It does not produce irritation of the kidneys by rapid elimination of iodoform and in that respect is an improvement.

Dr. S. von Ruck, Asheville, N. C.: Although the surgical treatment of tuberculous bone and joint affections is the subject more particularly under discussion, a few minutes' consideration of the treatment of tuberculosis of joints with certain laboratory products of the tubercle bacillus may be of interest.

From our experience of more than fifteen years in the use of various culture products at the Winyah Sanitarium, in almost two thousand cases of tuberculosis, we are firmly convinced of the great clinical value of this method, especially when combined with proper dietetic, hygienic and climatic measures, in all forms of tuberculosis. We have been successful in accomplishing some remarkably good results in cases of joint tuberculosis.

I may briefly review two or three of these cases which have come under my personal observation in the last few years.

The first—that of a child three years old, both of whose parents were tuberculous—presented distinct clinical evidence of tuberculosis of the hip joint. There was marked retraction of the limb and a great

deal of pain, especially at night. After a few weeks' treatment the symptoms began to improve and after three months the child was apparently well and able to run about as actively as any healthy child should.

No other treatment was employed in this case and this result was obtained without extension of the limb and without putting the child to bed.

I have recently heard from the mother that there has been no return of symptoms after two years.

A second case was one of multiple joint tuberculosis in a young woman who, since her childhood, had been operated upon eight to ten times for the relief of tuberculosis of the hip and sacro-iliac joints. When she came to us she was unable to walk without a crutch, the pain at times was so severe as to demand morphia for its relief, her nutrition was poor and her lungs showed signs of early phthisis.

During the first few months of her treatment she developed successively swelling, pain and tenderness in both shoulder joints. These symptoms gradually disappeared and she recently returned home after about fourteen months' treatment apparently having recovered from both pulmonary and joint affections.

She gained between thirty and forty pounds in weight and all that remains in the way of symptoms is some occasional pain in the sacral region.

I will not take your time to review more cases, but from my experience in specific medication in tuberculosis, I feel certain that the results in these cases stood largely in relation to the method employed.

It seems to me that a serious problem for the surgeon, in these cases which advance to the stage in which surgical interference becomes necessary, is the danger of mobilization of the local infection at the time of operation, not to speak of the comparative frequency with which repeated operations are essential to secure enduring results.

I believe that in active immunization of the patient as an adjunct to other methods of treatment, the solution of these problems is to be found. That we do succeed in producing an immunity in our patients, I have no doubt. Not only are our clinical results most satisfactory in their permanency, but animal experiment, and also changes occurring in the blood in the nature of marked increase of sero-agglutinins while the patients are under treatment, have confirmed me in this opinion.

This method of treatment I am sure is capable in itself of producing brilliant results in early cases, many of which, without it, would certainly advance to the stage in which surgical interference offers the only prospect of relief.

Even in the advanced cases its value as an adjunct to surgery is a very significant one, and one which I sincerely hope will soon become generally recognized by the surgical members of our profession.

TUBERCULOUS GLANDS OF THE NECK BASED ON FIVE HUNDRED CASES

By C. H. Mayo, A.M., M.D.
Rochester, Minnesota

The lymphatic system is increasingly appreciated for its protective and nutritive value as well as for its action in maintaining metabolism. Until recently it has received but scant attention even from anatomists and at present the great majority of the profession do not consider the glandular system except when gross evidence of its disease is present. The defense function is an important one and it is not unusual for the glands to sacrifice themselves in resisting invasion. The countless battles of the lymphatic system, if won without tumor manifestation, are not considered and in fact often do not show except through blood changes.

The greater number of the lymph glands are arranged in groups, each of which drains certain areas. For convenience of description anatomists have named them according to their location. Those more remotely situated, or, superficial, deliver to groups of glands more nearly connected with the main lymph ducts. The lymph channels from one aggregation to another may vary in distribution. The efferent ducts from the tonsilar gland, for instance, may pass by many glands of its group to infect others in the lower part of the neck.

To find a single gland, or one or more groups of associated glands enlarged, the first thought that arises is, What is the infection? and the second, Where did it gain entrance? If a number of varied groups are diseased we ask, What is the general or constitutional cause of the manifestation? Seeing the cervical glands enlarged, and no others unless it be adjacent groups, we do not longer discuss the question of infection carried by the circulation, but we at once search for the most probable source of entrance, in the throat, nose, ear, scalp or teeth, unless there is other visible external cause. Among the ravages of tuberculosis in the soft tissues, none are more conspicuous than its

effect upon the cervical glands. By far the most common source of infection apparently is the tonsil. Exposed as it is to disease through food, drink and air, it is not surprising to find that its natural leucocytic protectors may at times be temporarily deficient.

It is probable that the lungs through air alone are more resistant to the various types of infection to which they are exposed than the glandular tissue of the mouth and throat. The numerous control experiments which have been made have thoroughly proven the possibilities in this line. In large clinics where microscopical reports are made, the high percentage of tuberculosis found in the tonsils has been surprisingly instructive. It appears that the tonsil often checks tuberculosis and maintains a prolonged local resistance to the passage of the bacilli to the first tributary gland. Again it seems that it offers almost no resistance, and while there are a few local changes, the tonsilar gland becomes infected with rapid involvement of the adjacent nodes in the line of natural lymph delivery.

With the blocking of glands and lymph channels by disease, other groups more superficial and remote may become involved by an effort at collateral circulation or a backing up of the lymph.

The fact that bacteria can be introduced into the circulation through intestinal absorption is too well known to need discussion. To reach the circulation it is probable that most germs even here pass by the lymph route and chyle duct. Most of our knowledge concerning it is derived from examination of the chyle flow.

In discussing the operative treatment we will not especially consider the various diseases of the lymphatic glands further than to mention some conditions to be differentiated, the operative indiction being the same in several of them.

The diseases most frequently mistaken for tuberculosis of glands are: sarcomas, Hodgkin's disease, carcinoma, acute mixed infection following throat affections in the young, the acute glandular fever of Pfeiffer and occasionally phlegmon.

We must consider also the cases of mixed infection in the young, usually under six years of age, in which one, and more often both, sides of the upper neck region become involved in an acute swelling following a sore throat. A large percentage of these cases after becoming densely hard, suppurate and are opened or discharge through self-formed fistulas, the process requiring several weeks. Other cases less virulent, or from a greater resistance in the patient, are more slowly

destroyed without active suppuration. These cases seldom require radical operations. The slow, painless and more chronic type of enlargement of the upper glands which seem to extend to other glands in the line of the lymph flow requiring as a rule many months to develop, are nearly always tubercular. There is an occasional anaemic patient with lowered resistance who appears with a rapid developing cervical glandular growth with the temperature changes which are so typical of acute tuberculosis. In these cases early liquefaction may form local abscesses.

With such a number of dissimilar causes of glandular enlargement and the natural variations of disease manifestations as modified by the character and degree of virulence as well as resistance, it is surprising that more mistakes in diagnosis are not made.

The first node involved and palpable is usually the tonsillar gland, felt in the space behind the angle of the jaw and in front of the sterno-mastoid muscle. This gland is the largest of the deep group in front of the internal jugular vein and is palpable in a large proportion of children. It is placed with a few glands below it in a line in front of the vein which extends one half its length from this point to the sternum. Just below the tonsillar gland these few connect across above the jugular and beneath the mastoid muscle with the great chain or mass of glands behind the jugular which extends from the mastoid to beneath the clavicle and from the deep vein to the trapezius muscle and somewhat under its lower border. This is the main group front and back of the internal jugular and the slow involvement of its upper portion means practically that the whole placque must be removed if the surgeon is to avoid repeated operations in the scar tissue of previous dissections.

There are many lymph glands in the parotid structure. When primarily involved by tuberculosis, it usually means that the infection has come from the middle ear but later will probaly extend to the deep glands. If the parotid group is enlarged following the involvement of the deep glands it is more often secondary and does not occur until practically all the glands below are choked by disease and the blocking of the lymph ducts leads to back invasion. This is true of the few superficial glands over the upper part of the sterno-mastoid muscle below the parotid, and also in front of the ear. In a few cases tubercular glands of the submental and submaxillary groups are primarily invaded from the teeth and gums or tongue, but it is usual that it indi-

cates obstruction of normal lymph flow and is an effort at collateral lymph return, the infection being carried against the usual current across the neck to involve the opposite side.

The number of glands in this group may vary within wide limits. In a case of sarcoma we have removed 108 separate glands of all sizes from a dissection of one side of the neck.

The post-pharyngeal glands when involved by tuberculosis may liquefy and open into the cellular space behind the pharynx and develop post pharangeal abscesses, a not very common occurrence.

The radical operations upon very acute tuberculosis are questionable procedures. In spite of all we can do for tuberculosis as a local disease there is much dependent upon the reparative powers of the patient. In most cases more can be done to treat these patients by improving their resisting powers to develop auto anti-tuberculin, as it were, until the acute condition passes, or at least becomes local before operation is made. There is no question about the reparative ability in most of those suffering from chronic tuberculosis when the disease can be removed by operation, but much judgment is required if there is associated with glandular disease, tubercular deposits in other organs.

Treatment may be classed as non-operative and operative. The first includes general hygenic, medicinal, X-ray and congestive therapy. The prophylactic operative includes the removal of the tonsils and adenoid tissue in the young for its local and general effects and possible destruction of the original source of disease even when enlarged glands are present. It is a noticeable fact that chronic tubercular patients seem to bear ether anaesthesia very well.

Direct surgical treatment is palliative and radical. It is our belief that tubercular glands are best treated by their removal. The glands as such are destroyed by the disease while the bacilli may be held for an indefinite period ready to develop should an opportunity present itself by a lowered state of vitality in the patient. But it becomes a question what is best to do in certain cases and palliative or divided operations may become a necessary part of the surgical treatment. The few rules we have found useful in palliative operations in the various varieties of tuberculosis are—to incise and curette acute tuberculosis when large abscesses occur; then after applying iodoform emulsion or tincture of iodine to close the incision and avoid prolonged drainage. In gland sinuses mixed infection is probably present and these should be curretted, removing the remains of the infected gland. The sinuses and

cavity are stimulated and rendered sterile as possible with carbolic acid and iodine or some similar application. When the sinuses are all healed, an operation for the radical removal of the glands is indicated. Local areas of liquefaction from gland destruction in chronic processes and in which there is unbroken skin can be operated as if not involved, the incisions being cleansed with strong iodine water or Harrinton's No. IX solution before closing. These solutions are stimulating, draw serum, and the latter checks lymph absorption.

The radical operation should be a complete one for the removal of the group or groups involved, as only in this way can recurrence be limited to a small number. While the work should be complete, like that for malignancy, the failure to render it so is not followed by such dire consequences, and we cannot justify so extensive and mutilating an operation as is often made for cancer. The scar should be as little disfiguring as possible yet the incision must be free enough to enable a thorough dissection. Muscles as a rule should be left uncut and the essential motor nerves intact. In our early surgical work upon glands we made one or at times several short incisions in the cutaneous lines of the neck and removed all large glands to be found. But the number of reoperations following this method necessitated many changes in the operative incision to make a more complete removal of the various groups possible. Later we made a straight incision over the line of the sterno-mastoid muscle which was then converted into a Z by forward and backward ones at top and bottom. This muscle was frequently severed as well as the omo-hyoid. Later S-shaped incisions were made. For a number of years we have employed an incision which begins one inch back of and below the tip of the mastoid extending down the edge of the trapezius half way to the clavicle, about where the spinal accessory approaches the muscle. It then follows the natural skin creases, or lines curving forward to the anterior sterno clavicular region and ending between the divisions of the sterno-mastoid muscle.

The platysma myoides muscle is incised and lifted with the skin flaps. The external jugular is cut and ligated and the posterior edge of the sterno mastoid muscle is freed from below up. At about its mid portion the superficial bundle of sensory nerves is found and all are cut to mobilize the muscle. One half inch above this point the spinal accessory nerve usually emerges from the posterior edge of the muscle (occasionally it passes beneath the muscle sending a branch to it). This nerve should be saved and is best isolated at this time by loosening

it along the anterior border from the mastoid muscle to the lower part of the trapezius, cutting the deep communicating branch. The mastoid muscle is now exposed to the top of the incision. A blunt retractor is hooked under the pulley of the omo-hyoid and the dissection of the glands is begun at the bottom. The most useful instrument for the purpose is a probe-pointed pair of scissors which serve both to separate the tissues by spreading and cutting when necessary. From the tissue fibrosis developed, following X-ray applications, knife dissection is required for the patients so treated. After the internal jugular vein is separated for a short distance in the lower angle a ball of gauze is placed beneath the pulley of the omo-hyoid to compress the lumen of the vein after Murphy's plan. This maintains a full vein above, which will bleed if opened and not inspirate air. Those who have no fear of air embolism have either mistaken air suction into the mediastinal space for the real thing, or have read of experimental work in this line, by those who have injected a syringeful of air through a needle into the veins during several heart beats. However, this compression saves the temporary ligature which Fenger recommended to be placed for safety upon the vein, as one of the first steps of the operation. The glands should be removed in one large placque from below up. When the level of the spinal accessory nerve is reached the mass of gland is passed under the nerve and the dissection continued above to the tip of the mastoid and parotid. The mastoid muscle will tract inwards so that the tonsillar gland with the few below it, anterior to the jugular, can be removed without making another incision. Should there be enlarged glands beneath the chin and along the submaxillary region a separate incision is made across the neck over the hyoid bone curving with the lines of the skin. The outer ends of the incision should be three-fourths of an inch below the angle of the jaw to preserve the facial nerve branches to the lower lip and angle of the mouth. This incision is through skin and also platysma where present and the flap elevated to the line of the lower maxilla. In the worst cases we make a similar incision to that for removal of glandular cancer by connecting the two incisions below the mastoid process. The sterno-mastoid muscle is cut across below its attachment to the mastoid and turned down and forward, care being taken to preserve the spinal accessory nerve. This exposes freely a very inaccessible field, without injury to the nerve supply of the muscle, the latter being united by mattress sutures at the close of the dissection. The submaxillary gland is rarely

involved by tuberculosis but the parotid gland has many lymph nodes, and it is not best to search for these if they cannot be palpated with the fingers placed above and beneath the parotid in the incision. If the glands are found in this structure they are removed by blunt dissection and curette. This region furnishes nearly three-fourths of the recurrence of the disease, as these glands may be infected yet not palpable at the time of interference. There are also two other regions to be examined to prevent leaving disease, namely, look for one or two glands on the top of the internal jugular vein two and one half inches above the sternum. The other situation is under the anterior border of the trapezius muscle. Having a large traumatized field from which the lymph absorbents have been removed it is better to drain. A spirally cut rubber tube containing a guaze wick serves every purpose. These are placed in small incisions favorably situated for drainage.

The cut platysma myoides is now sutured with a running catgut stitch the same suture being run back for a subcuticular skin closure. Suturing the muscle prevents scar spreading and the transverse incision makes an almost imperceptible line of closure. The main lateral incision is so situated as to be four-fifths under a low collar, while the upper part is in the edge of the hair line.

As to recurrence it is a bad term as they are only glands left and not new ones grown as is so often said to the discredit of the operation. It is improbable that the glands reform, although it is so stated by some observers. We tell patients that have no parotid involvement at the time of the primary operation that the glands may enlarge in this region requiring removal later, but that they do not grow again, and should any develop, that it is merely a local tuberculosis with the main channels to the circulation destroyed and if they appear they should be removed. In our early work there was a high percentage of recurrence from a lack of skill and knowledge. Later results have been better. During the last four years 235 cases were operated for primary tubercular lesions of glands and 15 cases for secondary.

We have several times crushed one phrenic nerve without appreciable harm. Injury to one pneumogastric will cause but little effect upon the circulation. The superficial sensory nerves are freely removed but like other purely sensory nerves they are usually rapidly restored to function. The spinal accessory if severed should be sutured, as its loss of function causes a shoulder drop and in the young spinal curvature may be produced. The hypoglossal nerve should not be injured in

the dissection, but yet such an accident may occur from crushing it with forceps working in a bloody field. The injury shows an immediate effect on the tongue. The pleura is less often injured than is supposed.

The jugular veins can be removed but, with increased experience, we find it less often necessary to do so. These radical operations should be classed among the most difficult of any surgical dissection done with a low mortality, but we are more than repaid by the wonderful results obtained. If both sides of the neck are involved we do two operations, with an interval for recuperation between. On the left side care must be exercised in preserving the lymph duct. Although we have cut it a half a dozen times, it has always closed in from six to fourteen days having frequently more than one point of delivery to the venous system. We expect the young adult to gain from fifteen to twenty pounds during the first three months after the operation. There has been no mortality in the total number of cases reported.

DISCUSSION ON DR. MAYO'S PAPER

Dr. Floyd W. McRae, Atlanta: The point which Dr. Mayo makes with reference to complete removal of the glands and primary focus is very important, but exceedingly difficult of accomplishment. The complete removal of the primary focus is certainly advisable when it can be accomplished. With reference to the point that we have rarely to deal with a distinctly localized tuberculosis, I think that is one of the most striking points made.

One of the locations of the disease most confusing to me has been tuberculosis within the substance of the parotid gland, little nodes down in the gland, and I have made the mistake of thinking the condition sarcomatous and found my diagnosis changed on opening into the structure and subsequent complete recovery on removal of the tuberculous focus.

With reference to the method of treating the wound, I have had no experience with the various iodine preparations. I have confined myself to the use of carbolic acid followed by alcohol and I have felt that I have had very excellent results from a temporary drain with silk-worm gut, as first suggested by Ferguson, of Chicago. They are left in twenty-four hours and drain out the excess serum.

As to the incision, those who have not employed the incision recom-

mended by Dr. Mayo I am sure will be greatly pleased with the increased facility for removing these glands in this way. I first saw it in 1904 and have since employed it a number of times and been very much impressed with the greater ease with which I could remove the glands and the cleaner dissection that was done by this method.

I have been impressed with the few recurrences reported by Dr. Mayo as compared with my own results. I have seen a great many cases of tuberculosis of the glands of the neck, and it has been the rule with us, even with thorough operation, to find recurrences rather than the exception. I do not think we will have so many following the complete dissection recommended by Dr. Mayo. I have also been impressed with his good results; we have not been able to get such excellent results. I have known of two deaths from secondary hemorrhage.

Dr. John H. Gibbon, Philadelphia: This form of tuberculosis is one which I suppose appeals to the surgeon more than any other, because of its usual localized character, and the good results from prompt and thorough surgical intervention. The diagnosis is not usually difficult, although there has in the past been a tendency to look upon nearly all localized enlargements of the lymphatics as of tuberculous origin. During recent years considerable work has been done in the differentiating of diseases of the lymph glands. Not infrequently, however, a positive diagnosis cannot be made until the gland has been removed and examined both macroscopically and microscopically. In the early stages of Hodgkin's disease it is often difficult, if not impossible, to make a diagnosis. I have removed glands at this stage of Hodgkin's disease that presented the macroscopical appearance of tuberculosis. There is a simple hyperplasia of the lymph nodes which is also frequently mistaken for tuberculosis.

The treatment may be divided into medicinal, hygienic and surgical. It has been shown by statistics, especially those from large German clinics, that the results of hygienic treatment of tuberculosis of the glands has resulted in a large percentage of cures, but at least 25 per cent. of the cases not treated surgically subsequently develop pulmonary tuberculosis, probably 10 per cent. tuberculous meningitis, and a smaller percentage tuberculosis of the bones and joints. It would seem that the chances of pulmonary involvement are much less with thorough removal of the glands. In the early stages of tuberculosis of the glands of the neck all of us will be agreed that it is proper to

try alteratives in combination with hygienic and climatic treatment. I have been especially convinced of the efficacy of this treatment where the disease is limited to one group of glands, for instance, those at the angle of the jaw, where there is no involvement of the posterior chain, axillary glands, or those in the posterior triangle. With out-door life, and such alteratives as arsenic and the iodides, especially hydriodic acid, these glands subside. Where the disease is chronic, and where suppuration has taken place, nothing will result in a cure and prevent complications but thorough removal.

Senn was one of the first to show the advantage of repeated removal of these glands as they enlarged. Ten years ago surgeons did not operate upon any cases with less confidence than upon these of tuberculous glands of the neck. Now, with thorough removal, not only of the glands that are large or broken down, but of all the glands that are palpable, or that can be seen, the necessity for second operation is slight. I can say that in the last two or three years in my own cases recurrences have been very infrequent. I have several cases operated upon in this period in which there has been an extensive involvement of both sides of the neck, and in which there has been no recurrence after the complete operation. I think the prognosis is very much better than it was a few years ago, and that it is due to the more thorough removal of the glands. To simply remove the broken down glands is worse than nothing at all. One diseased gland affects another, and recurrence will take place. In this connection I would call attention to the necessity for examining the axillary space in all cases, because, as we pass down under the clavicle, we are apt to find a number of glands which should be removed at the same time.

The surgeon undertaking the operation for the removal of these glands should have a working familiarity with the anatomy of the neck, and the operation must be most thorough.

I have used the incisions recommended by Dowd, made in the natural folds of the neck, with great satisfaction, but of course, as Mayo has shown, it is difficult through this incision always to remove the glands which lie under the upper attachment of the sterno-cleido-mastoid. The incision, however, can easily be carried up beyond the hair line, and thus result in but a slight scar. Every effort should be made to close the wound so as to avoid all possible scar, and therefore the subcuticular suture is essential, especially in women.

Dr. Alexander H. Ferguson, Chicago: There are a great many things to be considered in this connection. One of the first things to do is to inspect the nose, throat and mouth, and anything wrong there should be corrected at once. Change of climate after that will result in cure in many instances. I deprecate the use of the X-ray, unless used in connection with suitable climatic and hygienic treatment.

The incision does not so materially matter. The experienced man can remove all the glands of the neck through different incisions. This incision, however, is one I use frequently. It has one objection, and that is the anesthesia that follows in the neck on account of the severance of the cutaneous nerves. There are a number of dangers in the operation; one is injury to the facial nerve, the branch running to the lower lip, which necessitates great caution in approaching the angle of the jaw and removing glands situated around and inside the parotid. This should always be done by blunt dissection and not with the knife. Injury to the sympathetic has occurred. The spinal accessory is perhaps the most frequent nerve injured in the operation. Sometimes it is unavoidably cut and then a secondary operation may be undertaken for relief of the condition produced. Then the thoracic duct has been injured, not to speak of the greater veins and arteries.

I deprecate the complete operation in combined infection. If tuberculous glands are broken down, the first thing to do is to find out if there is a mixed infection or not. The only case I have lost was one where I proceeded in spite of a mixed infection.

Dr. W. W. Keen, Philadelphia: I did not expect to take any part whatever in the discussion, but gladly respond to your request. I have been very much interested in this last paper because I have had a very considerable experience, now covering a good many years, in operations upon tuberculous glands of the neck.

I have never followed the practice of dividing the sterno-cleido muscle, for I have always found that by lifting it from end to end I have been able to get access to all the glands with perfect ease. As a general rule, I have made a single incision, a straight one, from the tip of the mastoid down to the sterno-clavicular articulation, and parallel with that muscle. Of course, the principal glands to be removed are those which are the most dangerous, namely, those in immediate contact with the carotids, the jugular vein, the subclavian, and occasionally, though rarely, the thoracic duct. On one occasion I have injured

the thoracic duct, but as a rule that injury occurs more frequently with sarcomatous glands on account of the greater adhesions. I am a strong advocate of the thorough extirpation of all these glands, and have practiced it for many years. It is a general rule in surgery that a thing that is worth doing at all is worth doing well and I never limit the excision to those that are enlarged. I remove every gland that I can find, big or little, because I am sure that the small ones will become enlarged, for they are already infected the moment there is enlargement of any of the glands of the neck.

In the matter of diagnosis I should like to say only a word or two; I have found that in a number of cases it has been very difficult to make a diagnosis between tuberculous glands and Hodgkin's disease, but I have found in the tuberculous glands much more commonly there have been chains of glands matted together as masses which can be distinguished as made up of individual glands rather than the enlarged single glands found in the early stages of Hodgkin's disease. When the latter has become well established, of course, there is little difficulty.

In closing, I should like to say a few words in reference to a little item of a literary character—the use of the words *tubercular* and *tuberculous.* I have had occasion recently to investigate with considerable care this question as to the distinction between the two words and have consulted with the editor of the Century dictionary, who has kindly agreed with me that the distinction I have laid down in certain papers I have had to send forth recently is correct; tuberc*ulous* should be used for those cases in which there is an infection with the *tubercle bacillus;* therefore we should always say "tuberculous glands" and not tubercular glands. On the other hand, tuberc*ular* should be used for those lesions which resemble tuberculosis, but are *not* caused by the tubercle bacillus, an example of which would be a tubercular syphilide. I think we should attempt to bring about uniformity in this respect.

I desire to congratulate the section on the most admirable papers that have been presented. They are practical, they are scientific, they have made contributions to our knowledge in original work both as to investigation in the laboratory and in the clinic and will do a great deal of good in forming the opinion of the profession on these subjects. Surgeons have not been very active in what I regard as the most magnificent crusade of the last ten years, the crusade against the great white plague. It has spread all over the world until there is not a country in the civilized world in which the contest has not waged and

waged with success. It has been chiefly by the physicians. We surgeons have been derelict in our duty because we have not come to their help in the matter of surgical tuberculosis as we should have done. I think one of the most important remarks made here to-day was that of Dr. Cabot on the duty of the surgeons to the public. We have not fully appreciated the importance of the sources of infection in surgical tuberculosis, through dressings and discharges.

SECTION OF TUBERCULOSIS IN CHILDREN

Chairman

WM. P. NORTHRUP, M.D.

New York

Secretary

R. G. FREEMAN, M.D.

New York

ADDRESS

By W. P. Northrup, M.D.
New York

Members of the Section: *Ladies and Gentlemen.*—In this, the second Congress of those especially interested in the study and the prevention of tuberculosis in the human family, there has been added a section in which this study is applied especially to children. There was a request for this section from various directions, and its natural demand called forth a ready response from President Biggs.

The study of tuberculosis, like the study of nephritis, began with the most pronounced forms under the designation consumption and Bright's disease. Consumption meant tuberculosis of the lungs, with excavation, wasting and exhaustion. Bright's disease of the kidneys meant anæmia, œdema, general anasarca. The study of both diseases has led to early recognition of the essential lesion, prevention of advance of process, and to cure.

Tuberculosis in young children has a few characteristics peculiar to the age of the patient. It is less apt to be limited to the lungs, and less apt to manifest itself in excavations with profuse expectoration. Further study has shown that tuberculosis in infants and young children is more apt to be of general distribution, or to be localized in lymph nodes, bones, lungs and meninges.

The name National Association for the Study and Prevention of Tuberculosis is an excellent one, and serves as a perpetual inspiration. The Association is a noble league to uproot and cast out the great white plague. First must be the study of the nature of the disease, next the means to prevent it, and lastly the cure of it.

This programme is intended to literally conform to the ideas expressed in the name of the Association. It takes account of the sources from which the infectious agent is most commonly derived, its hiding places, the portals through which it gains entrance to the body tissues, the protection of infants in menacing surroundings, the treatment of cases in whom the infectious agent has gained access, in

an effort to limit its progress, and finally the hygienic aids of greatest value in assisting the body cells against the germ cells.

Where may we better begin study and prevention than in children? In developing organs and growing systems comparatively slight injury or destruction of tissue results in lasting deformity.

Let this section then show its appreciation of the responsibility resting on it. Let its study be in the line of recognition of the surrounding sources of infection, of the early recognition of the first lesions, of how to prevent and how to cure, before deformity and impairment of function cripple the growing child.

THE PORTALS OF ENTRY AND SOURCES OF INFECTION IN TUBERCULOSIS IN CHILDREN

By David Bovaird, Jr., M.D.

New York

In venturing to attempt the task of filling the gap caused by the absence of Dr. Jacobi, the reluctance natural to such a situation is heightened by the fact that the theme to be discussed is not a new one. On the contrary, it has been often discussed in the writings of scientific men and the various views of individuals have been presented with earnestness, yet no general harmony of understanding has been reached. The very fact that discussion of the subject is still appropriate bears eloquent witness to the truth of the aphorism of Hippocrates, with which Osler prefaces his "Practice."

"Experience is fallacious and judgment difficult."

However, bearing in mind that the purpose of this Society is eminently practical, that we must seek not so much scientific accuracy as definite result and that the field of our labors is to be, not Europe, or Asia, but our own country, I shall endeavor briefly to put before you the views to which some years of observation and study have led me.

From the days when the experiments of Villemin proved the transmissibility of tuberculosis it has been accepted that the inoculation of tuberculosis would result in a definite succession of events in the affected animal. First of all, there would be a local lesion of the cellular tissues or skin in cases of subcutaneous infection, of the peritoneum if the infective material were injected into that sac, of the intestines in cases of feeding experiments, of the lungs when infected dust was inhaled. Then the lymphatic glands in closest relation to the original focus would become diseased, one gland becoming involved after another till a whole chain would be affected, and finally the deep thoracic or abdominal glands would give way and the disease would invade the viscera or by way of the veins would be transmitted everywhere throughout the body by the blood stream.

This same course of events has been observed in thousands of animals of many different species—rabbits, guinea-pigs, dogs, cats, pigs, horses, sheep, goats, etc., etc.

The belief that the same course would follow in man seemed, therefore, fully justified, was unreservedly adopted and for many years has served as criterion for the interpretation of the tuberculous processes of man. But within a few years doubt has been thrown upon this belief and confusion spread as to the soundness of interpretations founded thereon. Some feeding experiments have resulted not in abdominal, but in pulmonary tuberculosis. In some cases the local lesion of skin or intestine was found lacking. Some inhalation experiments have failed, others have resulted in abdominal tuberculosis.

Particularly influential in this way have been the experiments of Ravenel in producing pulmonary tuberculosis in monkeys and cows by intestinal inoculation.

The doubt thus thrown upon our methods of interpretations has resulted in leaving us in great uncertainty as to our knowledge of the portals of entry for tuberculosis in man.

It was, therefore, with great satisfaction that I recently read the masterly treatise of Cornet (in Nothnagel's Encyclopedia) on this theme. Without attempting to reproduce his evidence or line of argument permit me to quote the following conclusions:

1. Tubercle bacilli which have invaded the organism regularly develop at the site of invasion, or in the next set of lymph-glands.

2. The further dissemination is gradual, so that the pathological findings ordinarily furnish a clue to the site of invasion.

3. The theory of a special predilection on the part of the lung for the tuberculosis poison finds no experimental confirmation. The lung is first involved and shows the most advanced changes only in cases in which the infection travels by the air-passages; it is the organ last and least invaded in cases in which it is furthest removed from the primary seat of infection.

In brief, as the result of this masterly study by Cornet, the older methods of interpretation of the findings in tuberculosis in man are re-established as entirely trustworthy.

With that understanding, therefore, let us turn to the clinical and pathological data at hand to determine what are the avenues by which the tubercle bacillus obtains entry in man.

SECTION OF TUBERCULOSIS IN CHILDREN

There are five different routes by which tubercle bacilli may obtain entrance to the body:

1. By the placental circulation.
2. By contact with the surface of the body, the skin, the eye, the ear, etc.
3. By the respiratory tract.
4. By the digestive tract.
5. By the genito-urinary tract.

Infection through the placenta is possible. Tuberculosis in the mother may be transmitted directly to the child; but such transmission is so rare that from the standpoint of prevention it may, for the present, be disregarded. Wollstein, in her recent review of the subject, finds that there are reported in literature twenty cases of such placental infection, in which the facts given are sufficient to prove the case. This rarity of hereditary tuberculosis in man is fully borne out by the infrequency with which such transmission occurs in the lower animals.

Infection through the genito-urinary system is practically unknown in childhood. Tuberculosis of the kidney, bladder, ureter, etc., when it develops at this age is, in nearly all cases, simply part of a generalized tuberculosis with portal of entry elsewhere. We may, therefore, omit further discussion of this avenue of infection.

Infection through the skin is also of minor importance. Unquestionably in some cases tubercle bacilli obtain admission to the system through wounds or abrasions of the skin, through eczematous areas, etc., and taken up by the nearest lymph nodes give rise to a glandular tuberculosis. Infection produced in this way accounts for a small part of the cases of tuberculous adenitis, especially in the neck. It is also possible that in rare instances joints may be involved by extension from the skin or adjacent glands, but such processes play no role in the production of the tuberculous joints with which we are all familiar.

With the skin infections we may class the cases of primary tuberculosis of the conjunctiva or eye, of the ear and of the external genitals in which the disease is produced by direct contact with tuberculous material of any kind. Reports of such cases are common enough in literature to indicate that the danger of infection in this manner is real. The infective material in these cases may be the sputum of tuberculous patients, the organs of tuberculous cattle, even in some cases the milk of such cattle, or any other matter, human or animal, which contains tubercle bacilli.

It has long been assumed that some wound or lesion of the skin or surface was essential to the lodgment of the tubercle bacillus. Cornet has, however, demonstrated that the bacillus may make its way through the uninjured integument.

But with this fact admitted we all know that surface infections by tuberculosis play an insignificant part in the ravages of the disease. Only under especially favorable conditions can the bacillus effect lodgment on the surface, and even though it does live and develop in a surface lesion it rarely or never passes the adjacent lymph nodes. Surface lesions regularly remain local. A few cases of pulmonary disease following such lesions are recorded, but they are too few to be important in the great totals with which we have to deal.

We are therefore reduced to the consideration of the infections by the respiratory and digestive tracts. These are the two great portals of entry in the tuberculosis of children, and by one or the other route the great majority of cases of tuberculosis in childhood with which we have to deal is to be accounted for. The chief aim of this paper is to indicate to you the relative importance of these two avenues of infection and it seems to me that this can best be done by discussing briefly their relations to the more important clinical types of tuberculous disease in children, namely:

1. The glandular.
2. The pulmonary, including bronchial lymph nodes.
3. The intestinal, including the intestines, mesenteric lymph nodes and peritoneum.
4. The osteal, including bones and joints.
5. The meningeal.
6. General miliary tuberculosis may be omitted, being always secondary to one of the above types.

1. As to the glandular. The great majority of these cases affect the cervical lymph nodes or glands, 93 per cent. of 430 cases analyzed by Wohlgemuth. That cutaneous infection plays a small part in the production of these cases has already been stated. It is, however, to infection through the upper respiratory tract, the nose and nasopharynx, or the upper alimentary tract, the mouth and pharynx, that we must look for the causation of much the greater part of these cases. In this relation it is evident that the phaynx and tonsils may be classed either with the alimentary or the respiratory tract and may be infected by either avenue. Whether the cervical nodes are more often infected

through bacilli inhaled, that is by the respiratory tract, or by organisms admitted by the mouth, especially with the food, is an open question. At present there is no means of definitely deciding the matter. Many recent articles emphasize the importance of naso-pharyngeal adenoids and tonsils as the primary foci of such cervical adenitis. Wood (*Jour. A. M. A.*, May 6, 1905) has presented an excellent résumé of this subject. Involvement of tonsils or adenoids may be either primary or secondary. Considering the exposure of these parts which must be present in every case of pulmonary tuberculosis the secondary involvement is strikingly rare, just as is tuberculosis of the mouth under these conditions. The apparently primary disease of tonsils and adenoids is, on the contrary, of great importance. Not to weary you with statistics, I will quote only Wood's summary. In a total of 1,671 adenoids or tonsils examined (no tuberculosis elsewhere), tuberculosis was found in 88, or approximately 5 per cent. It is apparent, therefore, that these lymphoid structures constitute an important source of infection for the cervical lymph nodes. But years ago Jacobi pointed out that it was not so much to the tonsils or adenoids as to the lymph follicles in the nasal passages or the walls of the pharynx that we must look for the infection in tuberculosis of the cervical nodes, and that belief he still holds firmly. That these nodes do respond most quickly and certainly to inflammatory processes of any kind in the nose or naso-pharynx, and but slowly to processes limited to the tonsils, is a matter of almost daily clinical experience. Clinicians will, therefore, be likely to favor the view that infection of the cervical nodes is in most cases air-borne, but as already stated we have at present no information which enables us to decide what proportion of cases of tuberculous cervical adenitis is to be referred to inhalation, or to infection through the mouth. We must admit that the bacilli may enter in either way and from the standpoint of preventive medicine regard the two portals of entry as of equal importance.

2. As to the pulmonary and bronchial gland tuberculosis. In this category falls the great mass of all our cases of tuberculosis in children. In 125 autopsies on tuberculosis children in the Foundling Hospital Northrup found the bronchial glands tuberculosis in all—the lungs being also involved in most of the cases. In a second 125 cases in the same hospital the writer found tuberculosis in the lungs or bronchial nodes of all. The same is true of 119 cases reported by Holt. In 115 autopsies reported by Hand the bronchial lymph nodes were involved

in 81.7 per cent., the lungs in 78 per cent. of the cases. The most striking fact in the autopsy findings in tuberculous children is, therefore, the almost constant involvement of the bronchial lymph nodes, or lungs.

Not all of these are primary infections of the respiratory tract. It will be readily understood that in many instances the tuberculous processes are so widespread and so advanced in different parts that it is quite impossible to determine the location of the primary disease. Combining the observations of Northrup, Holt, Hand and myself, we can, however, say that in nine-tenths of all cases of tuberculosis in children in which the primary focus is determinable it is found in the bronchial lymph nodes or lungs. The question which most interests us to-day is, whether such location of the primary focus indicates that the infection is respiratory in these cases or not. Within the last few years the results of certain experiments made by Ravenel have cast doubt upon this subject. Ravenel, in two monkeys and one cow, produced tuberculosis of the lungs and bronchial glands, without mesenteric or intestinal lesions, by inoculating the food with tubercle bacilli. Failure to produce lesions of the lungs or bronchial nodes in inhalation experiments performed by other investigators has increased this doubt. But if one reviews the inhalation experiments of Villemin, Koch, Tappeiner, Thaon and, finally, of Cornet, he will be thoroughly and quickly convinced of the reality of inhalation tuberculosis with its primary focus in the lungs or bronchial lymph nodes. Tappeiner's assistant, Thaon, is said to have died of a tuberculous broncho-pneumonia, contracted during his experiments in this line. In 47 out of 48 guinea-pigs exposed to the inhalation of dried tuberculous material, as nearly as possible in the manner in which human beings are exposed to such infection, Cornet has produced typical tuberculosis of the lungs and bronchial lymph nodes, and to quote that investigator's own words: "These results destroyed the very foundation of Baumgarten's skepticism concerning the frequency of inhalation tuberculosis." They may likewise satisfy any doubts on our part. Of the bearing of Ravenel's experiments on this subject, I am not at present sure. The results are so exceptional, so at variance with those of many hundreds of other feeding experiments, that, until they are supported by further observations, I think it best to suspend judgment concerning them. From all the evidence at hand it seems to me that we can safely say that in nine-tenths of the cases of tuberculosis in children in America, where the

primary focus is determinable, that focus is in the bronchial lymph nodes or lungs, and it is the evidence of an inhalation tuberculosis.

3. Intestinal tuberculosis—including tuberculosis of the intestines, mesenteric nodes, and peritoneum—is frequently met with in children. In Hand's series of 115 cases, for example, the mesenteric lymph nodes were involved in 46 per cent., the intestines in 28 per cent., the peritoneum in 18 per cent. of the cases. In most instances all three structures are involved at the same time. The difference in the ratio of involvement of the intestines and mesenteric nodes reflects a fact with which we have all now become familiar, namely, that in infection by the alimentary tract, the bacilli may pass through the intestinal wall without producing a local lesion. The same fact has been demonstrated experimentally by Cornil and Dobroklonski and others. Passing the intestinal wall, however, they are regularly taken up by the mesenteric lymph nodes and in them they regularly leave the evidence of their progress. That has been the almost universal experience of experimental work on intestinal infection with tuberculosis.

Thus Nocard remarks: "By adding to the drinking water of young cattle tuberculous pus, or carefully diluted caseous material, one gives them to a dead certainty tuberculosis of the abdominal organs. These facts have been everywhere confirmed, notably by Saint Cyr for cattle, by Toussaint and Peuch for pigs, by Leisering for sheep, by Bollinger for goats, by Vincent for cats, and by Jöhne for most of the different species."

These facts constitute ample ground for regarding the unusual results of Ravenel's experiments as requiring further confirmation.

The intestinal tuberculosis of children is, however, accounted for in most cases, not by the ingestion of bacilli with the food, but by the swallowing of bacilli in matter coughed up from the lungs. The fact that young children do not expectorate is well known. In the light of their habit of swallowing whatever they cough up into the pharynx, the wonder is that all cases of pulmonary involvement are not complicated by intestinal lesions. The fact that the intestines sometimes escape, even when the pulmonary involvement is marked, points to the action of very potent protective agencies. What these are, there is no time to develop.

The important point at this moment is the rarity of primary intestinal tuberculosis in children in America. Estimates on this point vary considerably.

Northrup found three cases in 125 tuberculous children.

Holt found no case in 119 tuberculous children.

Hand found ten cases in 115 tuberculous children.

The writer found two cases in 125 tuberculous children.

Fifteen cases in 484—3 per cent. approximately.

That percentage may, therefore, be set down as probably caused by the ingestion of tubercle bacilli in or with the food.

Let me very briefly refer to the two final clinical groups:

a. Of bones and joints.

b. The meningeal.

These types are of peculiar interest because at autopsy they often afford us the best opportunity of judging of the source of primary infection. Theoretically we must concede that the meninges may be involved by extension of a tuberculous process from the nose, the ear, or the cranial bones, from foci in the bones or joints, or from any other tuberculous focus in the body, but practically such extension is very rarely seen.

I have hastily gone over the autopsy records of the Foundling Hospital for three years. In that time eleven cases of tuberculous meningitis had been thoroughly examined. In one of these cases the primary focus was intestinal, in one it was indeterminate, in the remaining nine it was in the bronchial lymph nodes or lungs. (In passing, I may say that I have also seen a case of tuberculous meningitis in which no other tuberculous lesion could be found in the body—a fact which has also been noted by Hand.)

I venture to quote the result of such a brief series of observations only because I am convinced that if all the cases in the Foundling Hospital records were studied the results would not be materially different from those given. Of the osteal tuberculosis seen in New York almost the same words may be used. When the primary focus can be demonstrated, it will in the great majority of the cases be found in the lungs or bronchial lymph nodes.

To recapitulate:

Glandular tuberculosis (cervical lymph nodes) may be produced either by inhalation or ingestion of the bacilli—probably most often by inhalation.

Tuberculosis of the bronchial lymph nodes or lungs is regularly an inhalation tuberculosis.

Tuberculosis of the meninges or bones and joints in the great ma-

jority of cases (9–10) has its primary focus in the bronchial nodes or lungs, and is therefore probably an inhalation tuberculosis.

Tuberculosis of the alimentary tract is primary (*i. e.*, produced by the ingestion of the bacilli) in a very small percentage of cases.

With reference to the sources of the bacilli which may infect children I shall be very brief, my views being already foreshadowed by my understanding of the routes of infection.

For evident reasons inhalation tuberculosis will regularly mean infection from other cases in man, an ingestion tuberculosis may be either of human or other origin.

The unity of tuberculosis in man and animals is established beyond question. Theoretically, therefore, one must grant that tubercle bacilli, whether from man or animal, set free in whatever way from the body of the original host, may convey the disease to children. Experience has, however, already demonstrated that tuberculosis is not easily transmissible in any case, and we are, I believe, satisfied that the discussion of this theme may at once be narrowed to the question whether the tuberculosis of children is derived in toto from previous cases in man, or in part produced by tubercle bacilli present in the milk of diseased cows.

Koch's declaration of the quality of human and bovine tuberculosis has been buried under a mountain of proof that the human disease can be transmitted to cattle. The demonstration of the presence in cases of tuberculosis in man of bacilli corresponding in every way to the bovine type of tubercle bacilli has established beyond question the communicability of the disease in the reverse direction. The theoretical aspect of the question is settled. Practically, however, it remains to be determined to what extent transmission from cattle to man influences the prevalence of the disease among children. For myself I am convinced that the part played by the bovine disease in this regard is a minor and for the present unimportant one. The reasons for this conviction are:

1. The rarity of primary intestinal tuberculosis in children. It will, I think, be conceded by all that if the ingestion of milk containing tubercle bacilli produces tuberculosis, in the great majority of such cases the lesion should be most marked in the intestines, mesenteric nodes and peritoneum.

It need hardly be pointed out that human bacilli may, by means of dirt on the hands, play-things, etc., of children, be ingested and may

at times produce abdominal tuberculosis. Indeed, the observations of Preissich and Schütz who found tubercle bacilli under the finger nails of a number of children not in direct contact with phthisical patients suggest that such a train of events is not infrequent.

We may, however, omit consideration of that factor for the present. The rarity of primary intestinal or mesenteric tuberculosis, as established at autopsy, has already been stated. On that point, as I have pointed out in a previous paper, French, German, and American observers are in practical accord. In Great Britain alone is any considerable proportion of such cases found in post-mortem work, observers in England and Scotland reporting as high as 30 per cent. of primary intestinal infections.

The justice of explaining such discrepancy of results on the basis of different interpretation of pathological findings has never appealed to me. Any tendency in that direction was checked by learning that the discrepancy is borne out by clinical observations. Two years ago, under the guidance of Dr. John Thomson, I was shown in a single morning in the Edinburgh Children's Hospital more cases of abdominal tuberculosis in children than I had seen in ten years' work in the hospitals and dispensaries of New York City. Abdominal tuberculosis in children is an every day experience with them; a rarity with us.

These differences in clinical and pathological observations are not to be explained by greater prevalence of tuberculosis in cattle in Great Britain, and they seem to me to indicate the working of some influences which have not yet been pointed out.

2. The paucity of cases in which the development of tuberculosis in children can be reasonably referred to the ingestion of the milk of tuberculous cattle. Five years ago, after a careful search of literature, the writer was able to gather together hardly a score of such cases. Careful watch in the intervening years has failed to add materially to that number.

It may readily be urged that infection with tuberculosis is regularly so slow and insidious that there would naturally be great difficulty in proving a case. While admitting some weight to this objection, it does not seem to me to satisfactorily explain the facts, if there is any great danger from milk. There are on record observations by veterinarians of herds of cows in which 50, 60, even 90 per cent. of the animals were tuberculous. The distribution of the milk of many of these herds must have been known, and if its consumption had resulted in the produc-

tion of any considerable number of cases of tuberculosis among children, the facts should have been capable of demonstration. So far as is known, no such demonstration has ever been given. On the contrary, a number of instances are on record where the milk of tuberculous cows has been consumed by families or groups of individuals, including children, for long periods of time without untoward consequences. Doubtless such instances are known to some of you.

3. Finally, the most conclusive argument against the influence of milk as an agent in the communication of tuberculosis to man is to be found in the careful studies of Biedert and Ganghofner. Biedert, in Upper Bavaria, and Ganghofner, in Bohemia, have made most careful comparison between the numbers of tuberculous cattle and the number of deaths from tuberculosis in man in the several districts of the country.

They could discover no relation between the factors, and both conclude that while bovine tuberculosis is transmissible to man, such transmission plays no important part in the prevalence of tuberculosis in man, and more particularly in children. From that conclusion in the light of our present knowledge I see no escape.

The source of the bacilli which convey tuberculosis to children is, therefore, to be sought in other cases of human tuberculosis. More particularly for reasons already suggested, the danger lies in the expectoration of consumptive patients. The tuberculous sputum, dried and pulverized, pollutes the air and inhaled by children, or carried by their hands, or other means to their mouths, reproduces the disease in them. As Comby put it years ago, "Les crachats, c'est l'ennemi!"

The sputum is our enemy. In it lurk the messengers of death. Control or conquer that source of infection, and tuberculosis among children in this country, if not entirely removed, will sink into comparative insignificance.

DISCUSSION ON DR. BOVAIRD'S PAPER

Dr. George M. Kober, Washington: In the absence of Dr. Ravenel, I desire to go on record as a believer in the transmission of bovine tuberculosis through the medium of the milk supply. According to Dr. Salmon, it has been proved that in some countries from forty to fifty per cent. of all cows have tuberculosis. In the United States the proportion is very much less, being probably not over five per cent. in

our worst affected states. The possibility of the presence of tubercle bacilli in cow's milk was first pointed out by Virchow and Koch as early as 1882, and subsequently the bacilli were demonstrated by Bang, Johne, Bollinger, Ernst, Woodhead and others in the milk of animals in which the udder was also the seat of lesion, and for some time it was doubted whether the milk from a cow is virulent unless the udder is the seat of the tuberculous deposits. In 1893, Theobald Smith, from a number of experimental observations, found that tubercle bacilli may be present in the milk, when the udder, so far as the naked eye could tell, contained no foci of disease. The general results of inoculation experiments would seem to indicate that the infectious properties are greatest with milk from animals with udder lesions and next from those affected with general tuberculosis.

Carmichael in his "Essay on the nature of scrofula with evidence of its origin from disorder of the digestive organs," London, 1810, in which he refers to a nascent diet, especially of cow's milk, as a frequent cause of scrofula, page 50, says:

"Infants at the time of weaning are from the change of diet particularly subject to bowel complaints, too often followed by disease of the mesenteric and lymphatic glands." He also quotes Weisemann, White and Lieutand to show "that whenever the outward glands do appear swelled you may safely conclude the mesenteric to be so too, they being usually the first part that is attacked by this malady." Carmichael, while he never saw a subject in the dissecting room with strumous glands externally without a similar state of those of the mesentery, insists that he has very frequently seen the latter unaccompanied by any affection of the external glands, which to his mind indicates that in scrofula the mesenteric glands are the first affected. With respect to the disease in question, we know that swine are so subject to one very similar that scrofula has in consequence derived its name from those animals. Swine, it is well known, fatten on butter and skimmed milk, and tuberculosis is on the increase among the American hogs.

La Billardière, in 1822, declared that the majority of milch cows in Paris perish from nodular consumption and asked, Is it possible that there is a connection between this and the many tuberculous diseases among the children in Paris?

Professor Kloncke, in an excellent little work published in Leipzig in 1846, gives the clinical history of sixteen children who had been fed with milk from "scrofulous tuberculous" cows, and all point to tuber-

culosis of the intestines, glands, skin or bone. In three of the cases he refers to the presence of indurated mesenteric glands. Apart from the statistical material bearing upon the extent of intestinal and abdominal tuberculosis, Salmon has analyzed the vital statistics of Massachusetts and finds an increase of thirty-six per cent. in the forms of tuberculosis other than phthisis, in the class under five years of age, while there was a reduction in the mortality of phthisis at all other ages of about forty-five per cent., and the vital statistics of Michigan from 1885 to 1906 show also a tremendous increase during the milk drinking age. In 1903 the speaker published eighty-six cases of milk bovine tuberculosis and offered the following conclusions: Tuberculosis may be transmitted to man in milk from tuberculous cows. The danger from this source is real and cannot be measured by the actual number of recorded cases, but should be judged in part at least by the inoculation and feeding experiments and the accidental wound infections which have established the intercommunicability of bovine and human tuberculosis.

2. The degree of danger may also be estimated by the prevalence of bovine tuberculosis and of the forms other than phthisis pulmonales in man, remembering that the infectious qualities of milk are greatest when the udder is the seat of lesions, and that Gebhardt's experiments have shown that tuberculous milk when diluted with the milk of sound animals in the proportion of 1 : 40 lost its infective power.

3. Further research seems desirable with a view of determining the frequency of primary intestinal and abdominal tuberculosis in all cases which come to autopsy, whether the child perished from tuberculosis or not, and in these autopsies the bacteriological examination should be directed to the existence of the two types of tubercle bacilli originally referred to by Smith and whether the bovine type predominates in the so-called scrofulous lesions.

Dr. Norman Bridge, Los Angeles, Cal.: It should be a matter for congratulation that Dr. Bovaird has shown that there is so little danger of infection of children by milk in this country. I would not, however, argue that we should not be careful of our milk supply on this account; we should be careful and most cities are trying to be careful. The various cities of this country are coming, one after the other, to adopt a system of inspection of dairies that are extremely useful. A few years ago we certainly were paying too much attention to this side of the question, fearing and believing that a great many children acquired tuberculosis through the food, and forgetting other important factors.

There was one great injury done in this excessive carefulness in the question of food, a too great swing of the pendulum. I am glad that the statements of Koch are shown to have been justified, although he was not justified in saying that human tuberculosis could not be produced from bovine bacilli. But he was justified in asserting that the great dangers come from the human bacilli.

I am sure, too, that we all feel grateful for Dr. Brannan's paper. I am particularly glad that he referred to the fact that there was a "draught" on the faces of the children at the Sea Breeze Hospital night and day. I am glad that he used that word, and that he talked just that way about it. The gospel that he has preached should be spread broadcast, namely, that the people should always be in a draught and not out of it. This is the only way we can be sure that the inspired air is clean air.

Dr. David Bovaird, Jr., New York: I was delighted to hear Dr. Ravenel's discussion. I quite agree with him that the infection from bovine species has been proven beyond a shadow of a doubt, but what I tried to bring out in my paper was its infrequency. From the standpoint of prevention the question of frequency is a vital one and, naturally, a difficult one to answer. Dr. Ravenel stated that thirty per cent. of the cases examined in England showed a distinct type of bacilli, the bovine variety. If I am not mistaken the cases they examined were exactly those regarded as instances of primary intestinal infection. I should like to ask if I am right, and if the cases examined were of that type? If so, then it appears that the bovine bacilli can be found in only thirty per cent. of the very cases which we have been willing to grant are possibly bovine infections.

The point that is of special interest to me is the original focus of the disease, particularly as it is shown in those children who have tuberculous disease of the bones and joints or tuberculous meningitis. The bones and joints, or the meninges, are not the original foci of the disease. We must look elsewhere. Take those cases and you will, as a rule, find unmistakable evidences of the disease in the respiratory organs. If this society expects to accomplish anything in the way of prevention of tuberculosis, it must look for the original focus of the disease, and not to the amount of damage that has been done in the bones and joints or elsewhere. In other words, if you are going to attempt to prevent tuberculosis in children you must give special consideration to the cases which show the primary lesion in the bronchial lymph nodes, or lungs.

TREATMENT OF TUBERCULOSIS IN EARLY LIFE

By J. P. Crozer Griffith, M.D.

Philadelphia

This is a problem so vast, even should we confine ourselves alone to the disease as seen in early life,—and this the nature of the subject will not permit—that it can be no more than outlined in the time allotted me. What I have to say is rather in the way of introducing topics for discussion by those interested in the matter. Consequently, all direct reference to the voluminous literature, and even the mentioning of writers by name is purposely omitted entirely, as otherwise the time limits would be far exceeded.

It may be best first of all to recall to our minds the fact that infection by this disease localizes itself in infants and children in a different manner from that seen in adolescents and adults. In infancy it is especially shown in the involvement of the internal lymphatic glands, especially the bronchial, in miliary tuberculosis of the lungs and in acute bronchopneumonia of a tuberculous nature, in meningitis, and in acute miliary tuberculosis attacking simultaneously many parts of the body. It is only exceptionally at this period that we find the formation of pulmonary cavities,—at least such as can be recognized during life.

During early childhood the tendency to tuberculous involvement of the bones develops, spinal caries and hip-joint disease being more prominent, although meningitis remains common. Tuberculous peritonitis is also a frequent form. Involvement of the lungs as a primary condition is not frequent except in the form of acute broncho-pneumonia. Later childhood continues to exhibit the peritoneal and osseous tuberculosis, and pulmonary tuberculosis now assumes the same form as in adult life, although it occurs less frequently.

The mode of entrance of infection into the system in the infant is a subject which has awakened extensive discussion in recent years.

It involves also the question of the possibility of human infection by the bovine bacillus, and consequently calls into question the etiological part played by contaminated milk. It would seem to me to be proven that both forms of infection, that with the bovine and that with the human tubercle bacillus, can certainly occur, but that the latter germ is the preponderating one. The much greater frequency with which tuberculosis of the bronchial glands takes place as compared with mesenteric glandular involvement seems to prove that the entrance of the bacilli is generally by way of the respiratory tract rather than by the gastroenteric. There are, however, weighty arguments on each side, and certainly no one dare use with impunity milk produced by tuberculous cows.

Treatment

A. *Preventive Treatment.*—In such a disease as this, for which there is but slight natural limitation and no positive cure, the enormous importance of prevention cannot be overestimated. Investigations have shown the great prevalence of tubercle bacilli in infected houses, and the germs have been found under the finger nails of infants accustomed, as children are, to crawl upon the floor. They can certainly be carried by the soiled hands of attendants. Infection through the kissing of children by diseased parents must frequently occur, since the bacilli are often found in the saliva. The germs abound in the dust of all places where expectoration of sputum has been unrestrained. This is certainly the carrier of them in some instances. The danger of transmission of the disease in day nurseries and in schools is a real one. Milk not carefully guarded may easily have enter it the germs of human tuberculosis. Many other probable methods of infection can be readily imagined, and it is the duty of physicians to guard against every conceivable source. Congenital tuberculosis certainly can occur, but undoubtedly most cases generally called "inherited" are in reality instances of family contagion. Yet a very great inherited *susceptibility* does exist among children born of tuberculous parents, and this brings up the question of the marriage of such individuals. While far from feeling that this should be discouraged, yet I cannot but believe that the production of offspring by them is unwise.

Apart from the inherited susceptibility there is also the acquired susceptibility which may come to every individual. Investigations have shown the possibility of tubercle bacilli lying dormant for years

in the bronchial glands. If the health is good this may do no damage, but should poor health supervene a migration of the germs to other parts of the body may readily be followed by a fatal issue. The same is true of the deposition of germs upon the mucous membrane of the respiratory or digestive tract. Unquestionably everyone, young and old, has this take place at times. It is only when some constitutional or local temporary lowering of the resisting power occurs that the germs penetrate and multiply within the system.

From every point of view, therefore, the necessity is forced upon us both of guarding children against the entrance of germs and of maintaining in them a perfect condition of health. Continued confinement in close over-heated rooms, over-work at school, insufficient and improper nourishment and the like must be sedulously avoided. All possible care must be taken to see that anæmia and general debility in children are removed by treatment, and that the bodily development goes on properly. Delicate flat-chested children may be greatly aided in this respect by gymnastic exercises, especially directed to the thoracic condition, and by the systematic employment of cool morning bathing followed by brisk friction. The danger of infection through adenoid growths and hypertrophied faucial tonsils is a real one and such conditions should receive appropriate treatment. The mucous membrane of the whole respiratory tract should be maintained in as healthy a condition as possible. Infants should not associate with a tuberculous nurse, or be suckled by a mother or wet-nurse who is the subject of the disease. Kissing by the tuberculous mother or by other tuberculous persons must not be permitted. All the food of the child and the utensils from which it is taken must be of unquestionable cleanliness. Where residence with a tuberculous subject is a necessity, extreme caution must be taken in the disinfecting of the expectorated matter and of the room and of all utensils and clothing in use.

The sending of city children into the country is a most serviceable form of preventive treatment. The various sanatoria and other charities established for this purpose have everywhere proven most effective. The establishing of open squares and small parks in the cities is of undoubted benefit. For those with sufficient means to accomplish it, the building of a roof garden on the residence and the keeping of the children there much of the time in good weather is to be urged. Delicate children and those especially susceptible should be frequently taken to the sea-shore, the mountains or other localities which are especially

conducive to the improvement of the general health. Such diseases as pertussis and measles, which are peculiarly prone to be followed by tuberculosis, must be guarded against with especial care.

B. *Treatment of the Disease.*—This subject may be divided into: (1) Hygienic treatment, (2) treatment by drugs, (3) specific treatment, (4) surgical treatment.

1. *Hygienic treatment,* including that by climate, is by all odds the most important. The fact pointed out years ago that tuberculosis had a certain tendency to limit itself, and will do so in a certain percentage of cases, has been amply sustained by subsequent experience. The hygienic measures, therefore, which aid in accomplishing this result are of great value. Those mentioned for prevention are of service here also.

It is emphatically the open air life with exposure to sunshine which is the important factor in the so-called climatic treatment of the disease. That good results can be obtained in almost any locality has been shown by the numerous reports emanating from so many diverse sources. Even in localities where the disease is most prevalent much good is accomplished by the open air life. The numerous reports of recoveries through tent life, even when carried out in the cities are very striking.

Yet there is no question that certain climates are more conducive to recovery than are others. I have myself the greatest confidence in the high, dry, sunny localities, especially for pulmonary cases, although probably all forms are benefited. The results which have been reported from Colorado, the Tyrol, and other similar regions are often surprising. Places of lower altitude, however, also give excellent results. This is true of such regions as the Adirondacks, the mountainous portions of the Carolinas, the lower mountainous regions of Germany, etc., etc. The sea level is not so popular as formerly, yet Southern California, the Riviera, etc., undoubtedly suit a great many subjects, and the good results from the sea-shore treatment for children, especially those suffering from peritoneal, glandular and osseous tuberculosis, are beyond question.

In selecting any out-door treatment in any locality there are certain other hygienic factors necessary for recovery which one dare never ignore. These are especially *rest, good food and comfortable surroundings.*

Rest is extremely important. In the Rush Hospital for Consumption

in Philadelphia I have seen fever disappear absolutely and steady gain in weight continue while the patient was confined to bed, and unfavorable symptoms recommence when the bed treatment was too soon abandoned. This experience is, of course, a common one with those dealing with the disease. It is of too frequent occurrence that one sees patients in climatic resorts acting on the principle that the mere change of climate is all that is required, and forgetting entirely the importance of prolonged rest as long as fever continues.

Good food, and plenty of it, is another essential. The tubercular patient *must* be fed in some way. This is often especially hard to attain in children, owing to the difficulty in gaining their coöperation. Forced feeding, even by gavage, may be necessary in some instances.

Comfortable surroundings, by which I mean those conducive to cheerfulness and general comfort are equally necessary. A selection merely of an apparently suitable locality from a climatic point of view is not sufficient. If the food and all the accommodations are bad, and if nothing is present to encourage cheerfulness and hope, climatic treatment will be vain. Tent life, for instance, is not always an advantage. The discomfort which attends it is often more than the patient can stand. Just as much fresh air can be obtained in other ways. So, too, some climates suitable for certain individuals are entirely too rigorous for others. Various and varied circumstances, then, are to be taken into consideration in selecting any climatic resort.

This brings us to the question of the value of sanatoria. Their chief benefit comes from the regulation of the life in all its particulars which is found there. The proper amount of rest, the character of the food, the amusement of the patient, and the comfort in general are all carefully attended to. There is no question that it is due to these factors that the results obtained in sanatoria are so excellent and so superior to those which the patient experiences if left to his own devices or to the unintelligent control of his relatives.

2. *Treatment by Drugs.*—There is no known specific for the disease, yet we must not forget that drugs can be of decided use to us. The principal medicinal treatment must be that directed to the restoring and maintaining the general health. Tonic measures of many sorts have been employed, especially such as alcohol, arsenic, iron, phosphorus, iodine, digitalis, creosote and cod-liver oil. The list of remedies which have been tried might be greatly extended. I am still old-fashioned enough to believe that cod-liver oil especially is a most

powerful alterative particularly for the glandular and osseous tuberculosis of children. Creosote and its derivatives have seemed to many careful observers to be of decided benefit in pulmonary cases and other tubercular lesions, and this is my own experience.

Then, too, drugs are of service for the symptomatic treatment of many conditions which seriously affect the general health such as diarrhœa, constipation, excessive perspiration, anorexia, cough, high temperature and the like. I will not take your time by going into a discussion of the various drugs which may be employed for these purposes, except to say that the various symptoms mentioned open the way for the use of astringents, laxatives, opium, atropin, bitter tonics, stimulants, antipyretics, etc. While believing thoroughly in hygienic treatment, I believe also in the employment of the proper drugs in the proper case. One must remember, however, that this is *symptomatic* treatment merely, and that overdosing must be avoided lest more harm than good follows.

3. *Specific Treatment by Tuberculin and Anti-Tuberculous Sera* was looked upon a few years ago as the final solution to the therapeutic problem connected with the disease. I voice the opinion of the great majority of physicians in saying that treatment of this sort has been one of our bitterest disappointments. My own early experience with it was unfortunate, and I have not again resorted to it. Yet the trend of scientific investigation in the case of other diseases certainly leads us to expect that eventually we shall find in this line a specific for tuberculosis. That the day may come soon is the earnest hope of all of us!

4. Finally, I will merely refer to the subject of *surgical treatment.* That the local absolute rest employed for the treatment of such conditions as hip-joint disease and spinal caries is of the greatest importance is shown by the good results which so often follow. Pleurisy, even when undoubtedly tuberculous, is followed in many instances by a cure, the result of aspiration of the fluid. An incision for tuberculous peritonitis has produced brilliant results in many cases. We may certainly hope that surgical interference may some day accomplish much for the analogous condition of tuberculous meningitis, which as yet remains one of the most hopeless of diseases. At least one case is reported where lumbar puncture, with the finding of tubercle bacilli, was yet followed by a cure. The disease then *can* recover.

Many other localized tuberculous processes can be treated success-

fully by surgical intervention. Tuberculous kidneys and tuberculous mesenteric glands have repeatedly been successfully removed. Regarding tuberculosis of the cervical glands, so common in children, the encouraging feature is that these glands act as a sieve, and that the progress of the bacilli to other parts of the body is arrested here in the great majority of cases. Yet the presence of tuberculosis in this region is certainly a danger, and it would seem better always to advise the removal of the glands, if nature does not accomplish this by absorption after a short interval. Certainly a mere incision with long continued subsequent suppuration is to be avoided if possible on account of the disfiguring scarring which is sure to follow.

THE PROTECTION OF INFANTS AND YOUNG CHILDREN FROM TUBERCULOUS INFECTION

By John Lovett Morse, A.M., M.D.

Boston

Frequency of Tuberculosis

Large series of autopsies in children under fifteen years of age show tuberculosis in from 25 per cent. to 35 per cent. Tuberculosis is very rarely found in the first three months (2 per cent. to 6 per cent.), increases rapidly in frequency during the rest of the first year, and steadily up to five years, after which the increase is slower, the percentage from this time on varying between 65 per cent. and 75 per cent.

Figures obtained in this way, however, do not give a true picture of the conditions among living children. The most reliable data on this point can be obtained from autopsies on children dead of the acute infectious diseases. The figures obtained in this way from large series in different cities show a frequency of tuberculosis varying between 16 per cent. in Boston and 24 per cent. in Prague.

Fatality of Tuberculosis

While the frequency of tuberculosis increases with age, the fatality of tuberculosis diminishes steadily during the first two years, after which it remains nearly constant. In almost every case in which tuberculosis is found in the first six months it is the cause of death, while this is so in only three-fourths of the cases in the second six months, the proportion diminishing steadily with age. The fatality of tuberculosis in early life is due to the great tendency to dissemination at this age, active general tuberculosis being found in about 75 per cent. of the fatal cases, while nearly 60 per cent. die of tubercular meningitis. Very little tendency to healing appears until the third and fourth years.

Mortality of Tuberculosis

The number of deaths from tuberculosis is almost nil during the first months of life but increases progressively afterward, the increase being especially rapid from one to two years. The first maximum is reached between two and four years. After four years the mortality diminishes to puberty.

These facts justify the conclusions that tuberculosis is an extremely important and fatal disease in early life, well worthy of serious attention, and that it is almost never intrauterine in origin, but an acquired and hence a preventible disease. The malignancy of tuberculosis, the absence of any tendency to healing and the great tendency to dissemination in infancy and early life are, moreover, extremely strong evidence against the verity of Behring's theory.

During infancy and early childhood, when the mortality of tuberculosis is greatest, the child rarely leaves its home. Later, when the child plays out more and goes to school, the mortality diminishes, showing that the danger of contagion is greater at home than abroad and that, while all sources of contagion must be considered, our attention must be devoted especially to the prevention of domestic infection. Contagion alone is not sufficient for the development of tuberculosis; there must also be a favorable soil or predisposition. Measures for the prevention of tuberculosis in childhood should, therefore, be divided into two classes; those intended to diminish the susceptibility to tuberculosis and those intended to prevent contagion.

Susceptibility to Tuberculosis and Methods for Diminishing It

Heredity.—While direct heredity, either from the sperm or through the placenta, practically never occurs and although the children of the tuberculous if removed from their parents at birth do nearly as well as the children of the non-tuberculous, it seems safe to assume that a predisposition, or better, a diminished resistance to tuberculosis is inherited. This susceptibility is probably greater than that transmitted by other debilitated or alcoholic subjects and different from the natural predisposition of early life. Exposure to house contagion is not sufficient in itself to explain the greater frequency of tuberculosis in the children of tuberculous parents.

Theoretically, marriage should be forbidden to the tuberculous, but practically this is impossible. It should be permitted, however, only to those in whom the disease has been quiescent for several years, who have a good constitution and a good family history.

Improper Food and Hygiene.—An increased susceptibility to tuberculosis is very easily acquired as the result of improper food, bad hygienic surroundings and lack of air and sunlight. The remedy is obvious; its application often difficult. Everything which tends to provide the poor with proper food and everything which gives the children a greater supply of fresh air and sunlight is important in that it tends to prevent the development of this acquired susceptibility. Every new park, every new playground, every improved tenement, every vacation in the summer aids in the fight against tuberculosis.

Diseases of the Mouth and Throat.—Diseases of the mouth and throat, hypertrophy of the tonsils and adenoids, especially if accompanied by cervical adenitis, all open the door for the entrance of the tubercle bacillus and should, therefore, receive early and active treatment.

Measles, Pertussis and Influenza.—Bronchitis, and measles, pertussis and influenza, if accompanied by bronchitis or throat affections, are often followed by tuberculosis. They do not, of course, cause tuberculosis but either stir a latent tuberculosis into activity or prepare the ground for it by the lesions and general enfeeblement which they produce. Measles and whooping-cough should, therefore, be avoided if possible and, if contracted, the children should be protected even more carefully than usual against contagion, not only during the illness but also during convalescence. The public must be taught to appreciate the dangers of measles and whooping-cough, they should be reported to the boards of health, and patients afflicted with them should be isolated.

In short, every child that is predisposed to tuberculosis should be given a régime which will tend to make its organism more resistant. It should have proper and sufficient food, air and sunshine, cold bathing, live in the country if possible, begin school late and have its throat put in normal condition.

Methods of Contagion and the Means to Prevent It

The bacilli of tuberculosis are contained in the milk of tuberculous animals, the excretions from various tuberculous foci and the sputa of patients with pulmonary tuberculosis. Contagion, in the vast majority of cases, occurs through sputa. The organism may be infected, in order of frequency, through the mucous membrane of the cavities

of the mouth and throat, the bronchial mucosa, the intestinal mucosa, the skin and the genital organs. Infection through the skin and genital organs is, however, extremely unusual.

Contagion by Milk.—Tubercle bacilli have been found but once in the milk of a tuberculous woman. A tuberculous woman should not nurse her child, however, even if she is able to do so, both because it debilitates her and because the infant not only suffers on account of an insufficient or abnormal supply of milk but runs the risk of direct infection through the secretions of the respiratory tract.

This is not the place to discuss the bacteriology of human and bovine tuberculosis. It is safe to conclude, however, that the tubercle bacillus of the bovine type can produce tuberculosis in man and that it can be transmitted in foods coming from tuberculous animals, especially in the milk of cows with mammary tuberculosis. The role played by infection from animals is undoubtedly insignificant in comparison to that from the consumptive man, but it is important enough so that it would be contrary to all wisdom to relax in any way the laws formulated or the precautions now taken against bovine tuberculosis. The sale of the milk or milk products of tuberculous cows should be prohibited. The tuberculin test should be used to determine the presence or absence of tuberculosis. In all cases in which there is any question as to the purity of the milk supply, the milk should be pasteurized for twenty minutes at not less than 155° F. Milk being a good culture medium and carrier of the tubercle bacillus, no one with open tuberculosis should be allowed to handle it in any way.

Contagion by Sputa.—This is the usual agent of contagion. It is dangerous when either moist or dry. It is more dangerous in doors than out of doors, where, under favorable circumstances, the bacilli soon die. Tubercle bacilli are most numerous in the dust of the dwellings of the tuberculous and especially in the dust of the floors. Older infants and children may get the dust and dirt on their hands and then put their hands in their mouths or on their food. Preisich and Schütz found tubercle bacilli in the dirt under the nails in 14 per cent. of sixty-six children between six months and two years coming to the Out Patient Department of the Stephanie Children's Hospital, showing the alarming possibilities of contagion in this way. Tubercle bacilli may also be carried in the fine liquid particles projected during cough, loud talking and sneezing. The droplets may be thrown as much as a yard.

Contagion by Other Tuberculous Excretions.—These may carry the tubercle bacilli in the same way as the sputa and enter the body by the same portals.

Direct contagion from sputa, projected droplets, kissing and close contact, is the most common method of infection in the first few months or year. When the infant begins to handle things and to get his hands dirty, indirect contagion also plays an important part.

Means to Prevent Contagion.—It is comparatively easy to guard the child against contagion when there is no consumptive in the family. It must take only pure or pasteurized milk. It must not be taken to visit consumptives or have them visit it. It must not be kissed. It must not be allowed to play where people are allowed to spit; better than this, all expectoration in public places should be prohibited. It must not go to live in a house vacated by a consumptive unless it has been thoroughly disinfected. Compulsory notification of tuberculosis will aid in accomplishing this.

It is, on the contrary, extremely difficult to guard the child against contagion when there is a consumptive in the family. This is especially true among the poorer classes where overcrowding, with the consequent increase in the opportunities for infection, is the rule and where all or most of the causes which increase the child's susceptibility are active. The importance of family contagion is shown by the fact that Comby found parental tuberculosis in more than one-third of the cases in which he found tuberculosis at autopsy. The first principle in the treatment of these cases is to get the patient out of the house if possible. A servant or nurse should always be discharged. A parent or other member of the immediate family should leave if possible. The public should provide sanatoria or hospitals for such patients, if they are unable to take care of themselves. If, as is usually the case, the patient is obliged to stay at home, the children should, if possible, be sent away, preferably to the country. The protective influence of country life on the children of consumptives is shown by Dr. Mercier's results. Only three per cent. of the children of tuberculous parents sent to the country died, while fifty per cent. of their brothers and sisters who remained at home perished. The work of The Society for the Protection of Children Against Tuberculosis, recently organized by Grancher in France, is along these lines. They take, however, only children between five and thirteen years of age, as they are less liable to the diseases of early infancy, and more resistant

to infection and can be of use to the family taking them. The cost per child is one franc per day.

When the patient or the children cannot be sent away, the measures taken must vary according to the circumstances in the individual case. In order to avoid direct contagion the patient and the children should be kept apart as much as possible. They should not sleep in the same room and certainly never in the same bed. Kissing must be prohibited. The patient must not cough, talk loudly or sneeze nearer than three feet from the children. In order to avoid indirect contagion, the sputa must be taken care of and destroyed according to modern methods. Nothing used by the patient should be used by the children. The children should be kept off the floor and out of doors as much as possible. The rooms must be cleaned by wiping with a moist cloth and not by sweeping and dusting. They must be aired and sunned as much as possible. In short, all the precautions which are in general use for the destruction of the sputa and the avoidance of contagion must be carried out, even more carefully than when adults only are exposed.

The results which have been obtained in New York during recent years as the result of the removal of advanced cases of consumption in the tenements to hospitals and of the disinfection of their apartments after their death or removal, and by the education of consumptives and their families as to the nature of the disease and the proper disposal of the sputa, as shown by the diminution in the death-rate from pulmonary tuberculosis and tubercular meningitis in children under fifteen years of age, are most encouraging. During the ten-year period ending in 1902, the death-rate from these diseases in children was more than 40 per cent. lower than during the previous ten years, the rate in 1892 being 5 per 10,000, and in 1902, 2.96 per 10,000. Dr. Biggs justly gives as his opinion, based on the results already obtained, that with an extension of the regulations now being enforced, a wider diffusion of information as to the nature of the disease and larger facilities for the care of advanced cases, there will be a still further and a rapid reduction in the death-rate from tuberculosis in this early period of life and that these data afford greater encouragement in the crusade for the prevention of tuberculosis than any others which are at our command.

To sum up, the separation of children from tuberculous adults until their recovery or death is the most simple and rational method of pro-

tecting them against contagion. Such separation is, however, often impossible. The only practicable method then is the observation in the best way possible in the individual case of the principles of hygiene and habitation. When a family is in reduced circumstances the public must step in to help them out. What can be done as to the separation of the children from the patients and as to sanitation depends in each case on the circumstances of the family and the provisions for the care of the tuberculous made by the public. That is to say, protection against tuberculosis is largely a question of money.

THE THERAPEUTIC VALUE OF SEA AIR IN NON-PULMONARY TUBERCULOSIS IN CHILDREN

By John W. Brannan, M.D.
New York

It was an Englishman, R. Russell, who first suggested the therapeutic value of sea air in scrofulous or tuberculous affections of the bones and glands, and it was in England that the first seaside hospital was established for the treatment of these affections. Russell's work, entitled "Glandular Tabes or the Use of Sea Water in Diseases of the Glands," was published in 1750, and in 1791 The Royal Sea-Bathing Hospital was founded at Margate by two English physicians, Lettsom and Latham. It contains one hundred and fifty beds, half of which are reserved for children. The patients lead an out-door life in all seasons, passing the day on the beach or on open verandas facing the sea, and sleeping in wards with the windows open on both sides so as to insure a thorough draft. There are several similar institutions on the seashore in England, as at Bournemouth, Brighton and Folkestone, but they are for the most part convalescent homes rather than hospitals for the treatment of tuberculosis in the active stage.

Italy was the first country to follow the example set by England, a marine hospital being established at Viareggio in 1856. Since then the number has rapidly increased until in 1904 there were twenty-three, distributed along the Mediterranean and Adriatic shores of Italy, with over ten thousand beds. The hospitals are closed during the winter. The first institution in France was founded by the city of Paris in 1860 at Berck-sur-Mer. It contains seven hundred and fifty beds. There are now fifteen sanatoria on the coast of France, open throughout the year, and in addition a number open for only a part of the year, containing in all nearly four thousand beds. Every other country in Europe, with the exception of Turkey and Greece, has one or more such hospitals, giving a total of seventy-five, many of them, however,

open only for a few months of the year. In South America, the Argentine Republic has one seaside hospital, established eighteen years ago, containing three hundred beds, and a new hospital of five hundred beds is nearing completion. In this country we have but the one experimental station at Sea Breeze, opened in June, 1904, by the New York Association for Improving the Condition of the Poor.

At the International Congress of Tuberculosis in Paris, in October last, reports were presented by Armaingaud of Bordeaux and D'Espine of Geneva on the marine sanatoria in all the countries of Europe. Everywhere excellent results were reported, whether the hospital was on the Baltic, the North Sea, the Mediterranean, the Adriatic or the ocean. In France alone 60,000 children have been treated in seaside sanatoria since 1887, with 59 per cent. of cures and 25 per cent. of cases decidedly improved, making in all 84 per cent. of favorable results, the percentage of cures ranging from 32 in Pott's disease to 74 in glandular tuberculosis. Investigations made by several independent observers showed that in about three-quarters of the cases the cures were permanent.

D'Espine stated that the reports from other countries were equally encouraging, the results naturally varying with the gravity of the case and with the length of the stay in the sanatorium. In the general discussion which followed the reading of the papers the opinion was unanimous that the marine climate was to be preferred to inland climate for tuberculosis other than that involving the lungs. Only two of the French sanatoria receive cases of pulmonary tuberculosis. The others exclude them, not always because of belief that the sea air is hurtful to them, but because of the fear of infection. Many of the speakers, however, urged that cases of pulmonary tuberculosis should also be admitted to the benefits of the sea air, but should be cared for in separate institutions.

D'Espine could find no difference in the general curative effect of the sea air in different parts of Europe, though he thought it possible that all stations were not alike in their action on the different forms of infantile tuberculosis. There was no doubt, however, in his mind that seaside hospitals are our main reliance in the prophylaxis and cure of tuberculosis in childhood, and in the prevention of phthisis in the adult. In this the Congress agreed with him.

Passing now to our own work at Sea Breeze, I shall not describe it in detail, as so much has been written of it in both the medical and lay

press. As already stated, the New York Association for the Improvement of the Condition of the Poor opened a tent camp on the shore of Coney Island in June, 1904. In the autumn the patients were moved to a permanent building adjoining, furnished with wide, open porches, and many windows, and with a capacity of forty-three beds. In all some fifty-eight children have been treated since the opening of the hospital. The patients are kept in the open air throughout the twenty-four hours, and throughout the entire year. During the day they are on the beach or open porches, which give right on the sea to the south, even the bed cases being carried out to cribs which remain permanently on the porch. At night the windows of the wards are wide open, even through the winter, being closed only one-half hour morning and evening when the children are being dressed and undressed. The temperature in the wards varies but little from that out of doors, ranging in the winter from ten to forty degrees above zero. The children are, of course, warmly clothed, wearing hoods on their heads and mittens on their hands. They never complain of cold, and there has not been a single case of pneumonia during the two years.

The diet is abundant and nutritious. The following is an average daily bill of fare:

Breakfast.—Boiled rice with milk and sugar, two helpings. Minced beef with potatoes, one or two helpings. Bread and butter, two to four, or even five slices. One to two glasses of milk.

Dinner.—Stew made of fresh beef and lamb, with carrots, onions and tomatoes; mashed potatoes; bread and butter, two to three slices; milk, one to two glasses; tapioca pudding.

Supper.—One egg; buttered toast, two to five slices; stewed peaches; milk as at breakfast.

In addition the children have a light luncheon of bread and butter or crackers and milk at ten o'clock, and fruit or crackers and milk at three o'clock in the afternoon. All this food is apparently digested and assimilated, thanks to the outdoor life of the children, and must be an important factor in their improvement, which begins almost at once. When they first come to the hospital they are usually pale and languid, with uncertain appetites and disinclined to play or even talk. In a few days their spirits improve, they sleep soundly, awake with an appetite and are anxious to get out of doors to play. The circulation gains in strength, the cheeks are reddened by the continuous exposure to the sun, and there is a constant gain of weight in almost every case. And

the improvement does not stop at the end of a few weeks, as we are so apt to see it in the sanatoria for adults, but continues throughout the stay in the hospital.

Dr. Ménard of Berck allows three years for the cure of a well established case of bone or joint tuberculosis, but unfortunately at many of the European sanatoria the patients are kept for only a few months, because of the demand for beds for other cases. At Sea Breeze the policy has been to retain the patients until they are well. In a few instances cases have been discharged because of the presence of pulmonary tuberculosis.

It is probable that the cases at Sea Breeze are, as a rule, more advanced than in the foreign sanatoria. In Europe they have learned by years of experience to send the patients in the earlier stages. At Sea Breeze no selection has been made, but patients have been accepted as offered until the beds were all full. Unfortunately very few were in an incipient stage. The great majority had well-marked tuberculosis of the bones or joints, only ten of the total number of fifty-eight having glandular tuberculosis alone. The severity of the cases may be judged from the fact that there were seventy-seven sinuses in the fifty-eight cases.

Before proceeding to speak of the results obtained, I must refer briefly to the surgical treatment, for we are dealing with so-called surgical tuberculosis. Very few operations have been performed, and those only of a minor character. Under the supervision of Dr. Charlton Wallace, fixation and extension have been secured in the most approved way, and every means made use of to get the patient up and about. The dressings are of the simplest possible character, as Dr. Wallace has related in a recent paper. All this is in accord with the practice in the seashore hospitals abroad, where operative measures are resorted to only in rare instances. This is forcibly expressed by Calot, who declares that formerly tuberculosis of the bones and joints, when accompanied by suppuration, terminated in death, even at Berck, whereas now it always ends in recovery, and this because formerly the tuberculous centre was always opened, whereas now it is never opened.

A few words as to the results. I have already spoken of the improvement in the general condition of the children, beginning at once with coming to the seashore. In most instances there has been a corresponding improvement in the local lesions, though sufficient time has not elapsed for a permanent cure in many. Of fifteen cases of Pott's

disease, two are cured, and eight decidedly improved. Of sixteen cases of hip disease, nine are decidedly improved, but none is cured. Of seventeen cases of tuberculosis of the knee, ankle, shoulder, or elbow joint, four are cured and the others all much improved. Of ten cases of glandular tuberculosis, six have been discharged cured, and three are decidedly improved. I am sorry to be obliged to add that one of the glandular cases discharged as cured in June last, with a gain of twenty-five pounds in weight, is reported to have developed pulmonary tuberculosis. This case, however, is complicated by the presence of tertiary syphilis. This is the only case of relapse that has occurred up to the present.

To summarize: We have 19 per cent. of cases cured (omitting, of course, the case of relapse), and 56 per cent. of cases improved, or 75 per cent. of successes, as the French put it.

It should be understood that the cases under review have not all been in the hospital for two years, but have come in from time to time as beds became available. The average residence has been sixteen and a half months, and, as might be expected, the degree of improvement has, as a rule, varied directly with the length of stay. There have been four deaths, and two patients are now moribund. Five of these cases had advanced hip disease on entrance (from one to four years' duration), with from two to eight discharging sinuses in each case. The sixth case was a negro boy with Pott's disease of long standing, as well as tuberculous disease of the elbow and jaw, with two open sinuses. They were all considered as hopeless by physicians in the city who sent them to us as a last resort. The same may be said with truth of a large number of other cases at Sea Breeze, some of which are now getting well.

When I set about preparing this paper a few weeks ago, I was interested to know what the most recent writers on orthopædic surgery had to say about the value of fresh air in the treatment of tuberculosis. So far as I knew no children's hospital in New York had attempted to carry out the methods which have proved so effective in Sea Breeze. I had visited a number of them and found no more ventilation of the wards than is customary in the general hospitals of the city. It was to my great surprise, therefore, on consulting the works of Whitman, Bradford, and Young, of this country, Keetley of England and Hoffa of Germany, that I found the same open air treatment most strongly urged that has been described above, except that no reference is made

to the seashore. Whitman recommends that not only the day but even the night should be passed in the open air, adding that the cure of tuberculosis of any part of the body depends upon the vital resistance, and that this is lessened by confinement and lack of exercise. Bradford advises the outdoor life that is recognized as of such value in the treatment of pulmonary tuberculosis (to use his own words), and speaks of the good results obtained at the Convalescent Home at Wellesley of the Boston Children's Hospital, where patients with Pott's disease and hip disease lived and slept throughout the winter of 1903–4 in an unheated shed with skylights or doors open. After referring to the treatment by fresh air and sunlight in the European seaside sanatoria, he concludes that "a convalescent home in the country is an almost necessary part of a surgical hospital for children." Young writes that "patients should spend as much time as possible in the open air. This has been made possible in late years by the various methods of ambulatory treatment which have almost entirely supplanted the old methods which necessitated spending long periods in bed. This has changed to such a degree that but few cases now require recumbent treatment." I need not quote from the other writers, as their views are the same as those just given. They also all agree in recommending conservative treatment in place of operative interference, emphasizing the good results due to the improved methods of fixation and extension, which permit the patient to be up and about in the open air.

It has remained for a general surgeon to put into practice the ideas advocated above. Many of you heard the admirable paper read before this Association last year by Dr. Wm. S. Halstead of Baltimore, and recently published in pamphlet form. Dr. Halstead for a number of years has treated in the open air all of his cases of surgical tuberculosis, mostly adults, and his results seem, as he himself puts it, almost marvelous. I commend his paper to those of you who have not read it.

It might be interesting, did time permit, to discuss the reasons for the difference between the theory and the practice of the orthopædic surgeons. Possibly some of them were revealed at the meeting of the surgical section yesterday afternoon, when papers were read on the treatment of tuberculosis of the bones and joints. Perhaps there are some surgeons with us to-day who will tell us why their books advocate the open-air treatment, and they themselves continue for the most part to practice what Young calls the "old methods." If I were to

hazard an explanation myself I should say that the surgeons have not yet had time to change their practice so as to conform with the newer methods laid down in their writings. In looking through the works of the writers mentioned above, I failed to find in the second edition of Bradford, published in 1899, any reference whatever to the therapeutic value of fresh air, whereas in the third edition, issued last year, the prime importance of outdoor life is urged in the strongest terms. We all know how long it took us, medical men, to appreciate the full significance of Koch's discovery, and how much longer it took us to accept the necessary measures of official control that were urged upon us by such leaders in thought and action as Biggs of New York.

Again, the hospitals are located in the crowded centers of cities, where the opening of windows means the entrance of dust and noise, both prejudicial to the general welfare of the patients and to the orderly conduct of the service. Those who have tried it know what it means to urge any such radical change in the administration of a hospital. Our chairman has had some experience in this matter in endeavoring to enforce his revolutionary ideas on the value of fresh air in the treatment of pneumonia. The moral of this seems to me to be obvious, place your hospitals for so-called surgical tuberculosis in the country or on the seashore, where all nature invites you outdoors. I do not mean homes for convalescents, but hospitals for the treatment of the disease in its active stage, as at Margate and Berck and the other European marine sanatoria. We should insist that all forms of tuberculosis are alike in requiring the outdoor life from the beginning to the end of the disease. Some of us think that in non-pulmonary tuberculosis sea air is especially indicated. There may be those who differ from us in this opinion, but we all agree that the air should be fresh and pure, such as is not readily found in cities.

DISCUSSION ON PAPERS BY DR. MORSE AND DR. BRANNAN

Dr. S. A. Knopf, New York: No modern idea has taken more hold of physicians than what has been presented as the open air treatment of many cases of surgical and pulmonary tuberculosis. Dr. Brannan has given you a picture of the work that is being done at Coney Island, and told us of the wonderful results obtained at Sea Breeze Hospital. He emphasized the fact that patients are exposed to draughts. He is right when he says draughts are harmless. There is, however, a dif-

ference between good and bad draughts; it is the difference between pure and impure air. The draughts in many parts of New York City contain much dust and quantities of microbes of all kinds. I do not fear the air in New York City—I fear the dust in the air. I advise my patients there when in the wind to always hold their hand before their mouth, not to talk, and to breathe through the nose.

Dr. Brannan has forgotten to tell of an interesting feature of the treatment at Sea Breeze, *i. e.*, the educational training and the moral effect produced thereby. It often happens, when the little patients, especially the boys, first come there they are given to much profanity; but when they leave they seem almost divine. Children there are taught to behave, to be moral, to use good language, and to be helpful.

There is another point that has not been emphasized sufficiently and that is that these children are not only taught not to fear draughts, but also not to fear the night air. I attach a great deal of importance to teaching the purity and harmlessness of night air. In my lecture to public audiences I emphasize this by saying "that the fear of night air is a night mare." At Sea Breeze there is absolute fearlessness of cold air and night air.

Dr. Robert Reyburn, Washington: In speaking of the treatment of tuberculosis at seaside sanitoria, it was my pleasure last September to visit Sea Breeze Sanatorium at Coney Island and what I saw there amazed me greatly. There were cases of tuberculosis in all parts of the body and the curious part was that surgery was not in demand in that institution. I have always been taught when there was any necrosis of bone that it was necessarily lost if of tuberculous origin. Yet here were a number of cases of spontaneous repair in a large number of cases involving the larger joints and the surgeon was not needed. All this was very amazing to me. My memory goes back fifty years and I never saw such examples of repair as I saw there at Coney Island, and I wish all the members present could visit that institution and see the effect of pure air, nourishing diet, and good hygiene in cases of tuberculosis of the joints.

Dr. Charlton Wallace, Sea Breeze, Coney Island, New York: It is indeed a pleasure for me to say a few words in reference to Sea Breeze. But before going into this subject I should like to say something regarding what Dr. Brannan has done, not for Sea Breeze, but for the crippled children of New York. When Sea Breeze was about to be closed in 1904, Dr. Brannan said, "No! How can you cure tubercu-

losis of bones in three months?" Dr. Brannan has been a great moral support to all who have been connected with the institution and we can never repay him for the time he has taken to go to Sea Breeze once a week; the three hours required means a great deal of time to Dr. Brannan. I know of no work in this country that has received the impetus that this work has through this one man's efforts. He has even gone to Albany, has consulted the mayor of New York City and done everything in his power to establish a permanent seaside hospital. We all have enjoyed Dr. Brannan's paper.

The treatment at Sea Breeze can be considered under four heads, viz.: (1) Sea air night and day. (2) Ample nourishing food. (3) The establishment of a happy, cheerful, child-like normal surroundings. We do not teach them that all cripples are doomed; we teach them that they must be helpful to one another. (4) The orthopædic treatment is simple and is carried out with but little manipulation, as little as possible. I wish to lay some stress upon the treatment of the sinuses; they are all treated without probing or packing, with nothing except the application of sterilized gauze placed abundantly around the wound in order to protect from outside infection. Under this simple treatment about one-third of the sinuses healed. Remembering that these tuberculous sinuses are not superficial, not from the muscles or soft parts, but lead down to the focus of disease within the bone, the aim therefore is to immobilize the joint. By resting the parts and causing a congestion of the leucocytes in the foci of the disease, the bacilli become encapsulated and the healing process begins. The treatment at Sea Breeze has been entirely on the grounds of fixation and immobilization.

If we have a beginning case of tuberculosis of the vertebræ, it is first treated by hyper-extension on a modified Bradford frame in bed on the veranda; but later the case is placed in plaster of Paris jacket and he plays out of doors. Thus supporting the parts, allowing rest to extend over months, gives the foci of the disease a chance to become healed. These children do not become dissatisfied, but are perfectly contented.

The treatment of the hip and extremity cases is practically the same. We use very little traction, aiming rather to get fixation with plaster of Paris. The knee cases all wear plaster of Paris bandages, except where there are sinuses. They are allowed to run around upon their diseased extremities. The patients sometimes pass through the most excruciating pain, but they are happy and cheerful.

What do we want? We want you to give us the beginning cases of tuberculosis of the bones and joints and we will turn out far better results than we have in the past. Our early cases do not go on to suppuration, but get well and, barring accidents, our prognoses will be such that nine-tenths of them will be going out with movable joints and not anchylosed ones. We are not satisfied with anchylosis of these joints; we want motion and a normally useful joint.

Dr. John H. Lowman, Cleveland: Enough cannot be said of the work among children at Sea Breeze, Coney Island. This institution represents the first attempt we have made to profit by the experience of France in the care of children, and it is remarkable that we have been so tardy in this most important matter. No one who has visited Berk-sur-Mer can soon recover from his surprise at the progress the children make in the maritime sanatoria. But it does not necessarily follow that similar good results will not be had if similar institutions should be placed along the borders of our great lakes. It is a great mistake to keep children with bone tuberculosis in the wards of a city hospital. We have learned that the ward is not the place for pulmonary tuberculosis, no more is it the place for bone tuberculosis.

The statistics of Armaingaud, showing a large per cent. of recovery in glandular and bone tuberculosis in the maritime institutions of France during the last twenty years, cannot be questioned. Since America has been so slow in adopting this procedure in bone tuberculosis, one must look for the cause of this conservatism. This conservatism of opinion, however, entails a radicalism of surgery. The percentage of operation necessary in children in the maritime institutions is one-fourth what it is elsewhere. And it must be that the profession in America is not aware of what can and is done in a sanatorium.

I sincerely hope that Sea Breeze will be enlarged and that a few more similar institutions will be established so that we can have our home statistics to convince those upon whom the French statistics have had so little influence.

Dr. Charlton Wallace, Sea Breeze, Coney Island, N. Y.: One year ago in Philadelphia I had a talk with Dr. Bennett concerning the Atlantic City homes. He stated: "We have done all in our power to get support and money in order that we may keep the place open during the entire year, but we are unable." I have only talked about Sea Breeze because that is the only one of the institutions of this kind at the sea-shore which is kept open the entire year.

SECTION OF TUBERCULOSIS IN CHILDREN

Dr. John Lovett Morse, Boston: As none of the surgeons of the Boston Children's Hospital are present and as I am a member of the medical staff of that hospital, I wish to correct an apparent misapprehension regarding the hospital and its Convalescent Home at Wellesley. If I am not mistaken "Sea Breeze" was not established until 1904; the Convalescent Home at Wellesley was established many years before that and has carried out the open air treatment for several years. The methods employed at both institutions are, I think, exactly the same, except that at Wellesley they have country air and not sea air. Our experience leads us to believe that children do just as well in country air as in sea air, and has not led us to think it advisable to change from the country to the sea-shore or an island. The children are not kept as long at Wellesley as they are at "Sea Breeze," but the results are distinctly good, although the time of their stay is limited. The children in the medical wards get the same fresh air treatment as do the cases of surgical tuberculosis.

There will be excursions to visit the Convalescent Home at Wellesley during the meeting of the American Medical Association in Boston in June.

Dr. John W. Brannan, New York: I have listened with much interest to Dr. Morse's statement about the good work in the convalescent home maintained in the country by the Boston's Children's Hospital. In my paper I referred to it with approval, but my contention is that we should not wait until our patients are convalescent, but send them out of the city, to country or sea-shore, as soon as the diagnosis is made, and keep them there until they are well. Tuberculosis of bone, as of the lungs, calls for an out-door life in pure air, such as cannot be obtained in cities. It is hospitals that are needed in the country, not simply convalescent homes.

Dr. Charles H. Mayo, Rochester, Minn.: With regard to glandular tuberculosis, there is no question at all but that under careful treatment they will subside. I have seen that occur under various types of treatment; at the same time, it does not *cure;* they have subsided or been held in subjection and may spring up again. Take for instance a young girl whose tuberculous glands have subsided; let her marry, become pregnant and go through lactation and up come the glands. This shows the glands were simply held in abeyance. The glands themselves do not destroy life; the function of these glands seem to be to hold in check that which tends to destroy the bacilli; we look upon

these glands as agents which produce something which destroys infection. You do not necessarily have to destroy bacterial life; these glands when diseased do not take life, but they furnish a focus for bacteria and deliver it to the circulation where it is distributed throughout the body.

Dr. Wm. P. Northrup, New York: I do not know much about calories, but I never saw such children, never saw such babies in my life. The Sea Breeze hospital is next door to Luna Park and many people seem to regard the babies more interesting and can be seen hanging around watching them. I consider that to be the greatest object lesson I ever looked in upon. To see these children living out of doors, playing in the sand, romping and playing "ring around a rosey," and not one in the game but has a game leg; and such color in their faces! Dr. Wallace has an awful collection of the ragged end of humanity, but he loves them and they get better. If an incipient bone case they get well. When you go to Luna Park just look over the fence and you will see a better show than all Luna Park.

I think we should formulate a resolution which embodies our belief regarding the treatment of tuberculosis in children and I will ask Dr. Brannan if he will not prepare a set of resolutions to offer before the adjournment of the meeting.

National Association for the Study and Prevention of Tuberculosis

CONSTITUTION AND BY-LAWS

LIST OF MEMBERS

January 1, 1906

NEW YORK
Irving Press, 225 Fourth Ave.
1906

The National Association for the Study and Prevention of Tuberculosis

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HONORARY VICE-PRESIDENT

DR. WILLIAM OSLER

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United Charities Building, 105 East 22d Street

NEW YORK

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CONSTITUTION AND BY-LAWS

CONSTITUTION

Article I. — Name

The name of this Society shall be The National Association for the Study and Prevention of Tuberculosis.

Article II. — Objects

The objects of the Association shall be: (*a*) the study of tuberculosis in all its forms and relations; (*b*) the dissemination of knowledge concerning the causes, treatment, and prevention of tuberculosis; (*c*) the encouragement of the prevention and scientific treatment of tuberculosis.

Article III. — Meetings

The meetings shall be held at such times and in such places as may be directed under the By-Laws.

Article IV. — Incorporators

The names and residences of the Incorporators are:

BY-LAWS

Article I. — Membership.

This Association shall consist of three classes of members: (*a*) Members; (*b*) Life Members; (*c*) Honorary Members.

(*a*) Those persons who participated in the organization of the Association at the Meeting in Philadelphia on March 28th, 1904, and such persons as shall from time to time be elected by the Board of Directors shall be Members so long as they comply with the provisions of the By-Laws. The dues of Members shall be Five Dollars ($5) a year.

(*b*) Members may become Life Members upon the payment of Two Hundred Dollars ($200).

(*c*) Persons distinguished for original researches relating to tuberculosis, or eminent as sanitarians, or as philanthropists who have given material aid in the Study and Prevention of Tuberculosis may be elected Honorary Members.

Article II. — Board of Directors

Section 1. The Association shall, at its first meeting, elect a board of thirty directors, divided into five groups of six each to serve one, two, three, four and five years, the duration of office to be determined by lot; thereafter, retiring directors, who have served a full term of five years, shall not be eligible for reëlection the year of retirement; provided, however, that this restriction shall not apply to the secretary or treasurer.

The Board of Directors may hereafter, at the annual meeting or at a special meeting of the Association, be increased to at least sixty, the additional members to be divided into groups in accordance with the provisions of the preceding paragraph of this section and subject to the same restrictions. It is furthermore provided that at least one-third of the total membership of the Board shall consist of laymen. At

annual meetings succeeding the increase of the Board of Directors to a membership of sixty, twelve directors shall be elected for terms of five years, or, in case of vacancies in any of the groups, for such unexpired terms.

Section 2. The Board of Directors shall make its own rules; the government of the Association, the planning of work, the arrangement for meetings and congresses, and all other matters appertaining to legislation and direction shall be in its hands; committees shall have the power to execute only what is directed by the Board.

Article III. — Election of Officers

The Board of Directors shall annually elect from its own number a President, two Vice-Presidents, a Secretary and a Treasurer, who shall be the officers of the Association as well as of the Board.

Article IV. — Committees

Section 1. The Board of Directors shall appoint an Executive Committee of seven directors, of which the president and the secretary shall be members *ex officio,* to which shall be entrusted all the executive work of the Association.

Section 2. The Board of Directors is empowered to appoint representatives on the International Committee on Tuberculosis; it shall also from time to time appoint such committees as may be necessary for scientific and educational work, and for the holding of meetings and congresses.

Article V. — Quorum

Seven Directors shall constitute a quorum of the Board of Directors.

Article VI. — Meetings

There shall be at least one stated annual meeting of the Association at a time and place to be fixed by the Board of Directors. Other meetings of the Association may be called by the Board at such times as it shall deem proper. The Executive Committee shall hold stated and other meetings as may be directed by the rules of the Board of Directors.

Article VII. — Moneys

The moneys received from membership dues and from all other sources shall be used for defraying the expenses of the Association, and for furthering its objects under the direction of the Board of Directors.

Article VIII. — Amendment of Constitution.

Propositions to amend the Constitution may be presented in writing at any meeting of the Board of Directors or of the Association; they shall be then referred to the Board of Directors for consideration and report. The Board of Directors shall report all propositions for amendment, whether submitted to it originally or by reference, at the meeting of the Association next following, when action may be taken; *provided however,* that no proposition for amendment shall be voted upon within thirty days after its presentation, or without at least twenty days' notice of the meeting at which it is to come up for consideration, which notice shall set forth the proposed amendment in full. An affirmative vote of two-thirds the members present shall be required for adoption.

Article IX. — Amendment of By-Laws

By-Laws may be amended in the same manner as the Constitution or by a two-thirds vote of the members present at a meeting of the Board of Directors, provided that in the latter case the proposition to amend has been presented in writing at a previous meeting of the Association, or of the Board of Directors, and that subsequently to such presentation twenty days' notice in writing has been given of the proposed amendment in the call for the meeting.

GEOGRAPHICAL
LIST OF MEMBERS

GEOGRAPHICAL LIST OF THE MEMBERS OF THE NATIONAL ASSOCIATION FOR THE STUDY AND PREVENTION OF TUBERCULOSIS

JANUARY 1, 1906

ALABAMA

CARY, Dr. C. A., Alabama Polytechnic Institute, Auburn, Ala.
JONES, Dr. C. C., East Lake, Ala.
THIGPEN, Dr. C. A., Montgomery, Ala.
WILSON, Dr. CUNNINGHAM, 1107 S. 20th St., Birmingham, Ala.

ARIZONA

DUFFIELD, Dr. WILLIAM, Phœnix, Ariz.
RODGERS, Dr. MARK A., Tucson, Ariz.

CALIFORNIA

ALDEN, Dr. C. H., P. O. Box 821, Pasadena, Cal.
BARLOW, Dr. W. JARVIS, 328 Wilcox Building, Los Angeles, Cal.
BARNARD, Mr. J. F., 2646 Ellendale Place, Los Angeles, Cal.
BRIDGE, Dr. NORMAN, 217 South Broadway, Los Angeles, Cal.
BROWNING, Dr. CHARLES C., Monrovia, Cal.
COBB, Dr. J. O., Los Angeles, Cal.
COLE, Dr. GEORGE L., 217 South Broadway, Los Angeles, Cal.
EVANS, Dr. GEORGE H., 293 Geary St., San Francisco, Cal.
FLINT, Dr., WILLIAM H., Santa Barbara, Cal.
FOSTER, Dr. N. K., Secy. State Board of Health, Sacramento, Cal.
HERSHFELDER, Dr. J. O., 1392 Geary St., San Francisco, Cal.
HUTCHINSON, Dr. WOODS, University Club, Redlands, Cal.
JOHNSON, Bishop JOSEPH H., Los Angeles, Cal.
KRESS, Dr. GEORGE H., 602 Johnson Building, Los Angeles, Cal.
LYLE, Dr. ANNIE G., 1150 Franklin St., San Francisco, Cal.
POTTENGER, Dr. F. M., 226 Bradbury Block, Los Angeles, Cal.
WARD, Dr. A. R., University of California, Berkeley, Cal.
WELLS, Mr. A. G., Gen. Mgr. A., T. & S. F. Ry., Los Angeles, Cal.

CANADA

Armstrong, Dr. G. E., 320 Mountain St., Montreal, Canada.
Elliott, Dr. J. H., Muskoka Cottage Sanatorium, Gravenhurst, Ont.
Malloch, Dr. A. E., 28 Duke St., Hamilton, Ont.
Parfitt, Dr. Charles D., Muskoka Free Hospital, Gravenhurst, Ont.
Primrose, Prof. A., 100 College St., Toronto, Canada.

COLORADO

Bergtold, Dr. William H., 1460 Clayton Ave., Denver, Colo.
Bonney, Dr. S. G., Stedman Building, Denver, Colo.
Campbell, Dr. W. H., 424 N. Nevada Ave., Colorado Springs, Colo.
Causey, Mr. James H., Boston Building, Denver, Colo.
Dennis, Dr. Frank L., 130 E. San Miguel St., Colorado Springs, Colo.
Edson, Dr. Carroll E., 305 McPhee Building, Denver, Colo.
Gardiner, Dr. Charles Fox, Colorado Springs, Colo.
Gildea, Dr. Patrick F., 2 North Cascade Ave., Colorado Springs, Colo.
Hoagland, Dr. Henry W., 327 N. Nevada Ave., Colorado Springs, Colo.
Holden, Dr. G. W., Agnes Memorial Sanatorium, Denver, Colo.
Holmes, Dr. A. M., 203 Jackson Building, Denver, Colo.
Lennig, Mr. Nicholas, 1058 Pearl St., Denver, Colo.
Lockard, Dr. Lorenzo B., 1427 Stout St., Denver, Colo.
Phipps, Mr. Lawrence C., Denver, Colo.
Pogue, Dr. George R., Greeley, Colo.
Scully, Dr. Daniel J., 1129 N. Nevada Ave., Colorado Springs, Colo.
Sewall, Dr. Henry, 23 18th Ave., Denver, Colo.
Solly, Dr. S. Edwin, 2 North Cascade Ave., Colorado Springs, Colo.
Swan, Dr. Will Howard, Colorado Springs, Colo.
Wilder, Dr. John A., Stedman Block, Denver, Colo.

CONNECTICUT

Aiken, Mr. William A., 157 Washington St., Norwich, Conn.
Alton, Dr. Charles De Lancy, 86 Farmington Ave., Hartford, Conn.
Beach, Dr. Charles C., 54 Woodland St., Hartford, Conn.
Brooks, Dr. M. J., New Canaan Sanatorium, New Canaan, Conn.
Carmalt, Dr. William H., 87 Elm St., New Haven, Conn.
Farnam, Prof. Henry W., New Haven, Conn.
Farnham, Mr. E. D., South Windsor, Conn.
Fisher, Prof. Irving, 460 Prospect St., New Haven, Conn.
Foster, Dr. J. P. C., 109 College St., New Haven, Conn.
Gaylord, Dr. C. W., Branford, Conn.
Ives, Mr. Frederick A., West Cheshire, Conn.
Lindsley, Dr. C. A., Secy. State Board of Health, New Haven, Conn.
Lyman, Dr. David R., Wallingford, Conn.
McCook, Dr. J. B., 396 Main St., Hartford, Conn.
McKnight, Dr. E. J., 110 High St., Hartford, Conn.
Maher, Dr. Stephen J., 212 Orange St., New Haven, Conn.
Osborne, Dr. Oliver T., 252 York St., New Haven, Conn.
Palmer, Mrs. I. E., 326 Washington St., Middletown, Conn.

Shepherd, Dr. George R., 667 Asylum Ave., Hartford, Conn.
Smith, Mr. Ernest Walker, Hartford, Conn.
Steele, Dr. H. Merriman, 226 Church St., New Haven, Conn.
Steiner, Dr. Walter R., 4 Trinity St., Hartford, Conn.
Swain, Dr. Henry L., 232 York St., New Haven, Conn.
Warner, Mr. W. A., New Haven, Conn.
Wright, Dr. Frank W., 48 Pearl St., New Haven, Conn.

CUBA

Jacobsen, Dr. J. L., Monserrate 2, Havana, Cuba.

DELAWARE

Black, Dr. John J., New Castle, Dela.
Hancker, Dr. William H., Farnhurst, Dela.
Lowber, Dr. Alexander, Secy. State Board of Health, Wilmington, Dela.

DISTRICT OF COLUMBIA

Baldwin, Mr. William H., Stoneleigh Court, Washington, D. C.
Barnes, Dr. Noble P., 212 Maryland Ave., N. E., Washington, D. C.
Barrie, Dr. George, 1601 22nd St., N. W., Washington, D. C.
Beyer, Dr. Henry G., U. S. Navy, Washington, D. C.
Carroll, Dr. James, Army Medical Museum, Washington, D. C.
Curtis, Mr. William E., Connecticut Ave., N. W., Washington, D. C.
Fremont-Smith, Dr. F., 1808 Massachusetts Ave., Washington, D. C.
Hege, Mr. S. B., 707 15th St., Washington, D. C.
Hickling, Dr. D. Percy, 1304 Rhode Island Ave., Washington, D. C.
Kean, Dr. J. R., War Department, Washington, D. C.
Keech, Dr. Thomas A. R., 217 Fifth St., S. E., Washington, D. C.
Kingsman, Dr. R., 711 East Capitol St., Washington, D. C.
Kober, Dr. George M., 1600 T St., Washington, D. C.
Lee, Dr. Thomas S., 1315 Connecticut Ave., Washington, D. C.
Leech, Dr. Olin, 631 Maryland Ave., Washington, D. C.
McKennie, Miss Annie R., 2819 14th St., Washington, D. C.
Metzerott, Dr. John H., 1110 F St., Washington, D. C.
Miller, Lieut. Com. Frederick A., 2201 Massachusetts Ave., Washington, D. C.
Phillips, Dr. W. F. R., Columbian University, Washington, D. C.
Pinchot, Mr. Gifford, Department of Agriculture, Washington, D. C.
Pinchot, Mrs. James V., 1615 Rhode Island Ave., Washington, D. C.
Ramsburgh, Dr. Jesse, The Portner, Washington, D. C.
Reyburn, Dr. Robert, 2129 F St., Washington, D. C.
Richardson, Dr. Charles W., 1317 Connecticut Ave., Washington, D. C.
Riggs, Mr. E. Francis, 1311 Massachusetts Ave., Washington, D. C.
Rives, Dr. William C., 1723 I St., Washington, D. C.
Rixey, Gen. P. M., Navy Department, Washington, D. C.
Rosenau, Dr. Milton J., Director Hygienic Laboratory, Washington, D. C.
Ruffin, Dr. Sterling, 1335 Connecticut Ave., Washington, D. C.
Shadd, Dr. Furmann J., 901 R St., N. W., Washington, D. C.

SMITH, Dr. ERWIN F., 1460 Staughton St., Washington, D. C.
SOHON, Dr. FREDERICK, 512 I St., N. W., Washington, D. C.
SOWERS, Dr. Z. T., 1707 Massachusetts Ave., Washington, D. C.
STERNBERG, Dr. GEORGE M., 2144 California Ave., Washington, D. C.
STRASBURGER, Mr. JOSEPH, Washington, D. C.
THOMAS, Dr. JOHN D., 1603 19th St., Washington, D. C.
TUCKERMAN, Miss E., 1600 I St., Washington, D. C.
WILDER, Dr. J. R., 412 B St., S. E., Washington, D. C.
WOODWARD, Mr. S. W., 2115 Wyoming Ave., Washington, D. C.
WOODWARD, Dr. WILLIAM C., 508 I St., N. W., Washington, D. C.
WYMAN, Gen. WALTER, U. S. Marine Hospital Service, Washington, D. C.
ZINKHAN, Mr. LOUIS F., Supt. Washington Asylum, 19th and C Streets, S. E., Washington, D. C.

ENGLAND

OSLER, Dr. WILLIAM, Oxford University, Oxford, England.

FRANCE

MAGNIN, Dr. A. J., 121 Boulevard Haussmann, Paris, France.

GEORGIA

COLEMAN, Dr. THOMAS D., 505 Greene St., Augusta, Ga.
HARRIS, Prof. HENRY F., Atlanta, Ga.
LYLE, Dr. W. C., Augusta, Ga.
OERTEL, Dr. THEODORE E., 308 Leonard Building, Augusta, Ga.

ILLINOIS

ALDIS, Mr. ARTHUR T., 247 Monadnock Block, Chicago, Ill.
ARMOUR, Mr. M. C., 1415 Monadnock Block, Chicago, Ill.
BABCOCK, Dr. ROBERT H., 92 State St., Chicago, Ill.
BAKER, Dr. A. H., Chicago Veterinary College, 2537 State St., Chicago, Ill.
BEVAN, Dr. ARTHUR DEAN, 100 State St., Chicago, Ill.
BICKNELL, Mr. ERNEST P., 79 Dearborn St., Chicago, Ill.
BILLINGS, Dr. FRANK, 35 22d St., Chicago, Ill.
CASSELBERRY, Dr. W. H., 34 Washington St., Chicago, Ill.
CROWELL, Mr. H. P., American Cereal Company, Chicago, Ill.
DAVIS, Dr. N. S., Jr., 65 Randolph St., Chicago, Ill.
DEERING, Mr. JAMES, 7 Monroe St., Chicago, Ill.
EVANS, Dr. W. A., 103 State St., Chicago, Ill.
INGALS, Dr. E. FLETCHER, 34 Washington, St., Chicago, Ill.
JOHNSON, Dr. FRANK S., 2521 Prairie Ave., Chicago, Ill.
KLEBS, Dr. ARNOLD C., 100 State St., Chicago, Ill.
LATHROP, Mr. BRYAN, 293 Dearborn St., Chicago, Ill.
MACARTHUR, Dr. R. D., Marquette Building, 414 Dearborn Ave., Chicago, Ill.
MCCONNELL, Mr. CHARLES H., 84 State St., Chicago, Ill.

McCormick, Mr. Harold, 7 Monroe St., Chicago, Ill.
McCormick, Mrs. Harold, 7 Monroe, St., Chicago, Ill.
Miller, Mr. George H., c. o. Sears, Roebuck & Co., Chicago, Ill.
Murphy, Dr. John B., 100 State St., Chicago, Ill.
Simmons, Dr. George H., 103 Dearborn Ave., Chicago, Ill.
Stevenson, Dr. Alexander F., 100 State St., Chicago, Ill.
Walker, Dr. Samuel J., 100 Lincoln Park Boulevard, Chicago, Ill.
Wells, Dr. Edward F., 4744 Woodlawn Ave., Chicago, Ill.

Edwards, Dr. Sanford P. S., Supt. Tri-City Sanitarium, Moline, Ill.
McHeigh, Dr. M. G., Consumptive Hospital, Dunning, Ill.
Pettit, Dr. J. W., Ottawa, Ill.
Sherwin, Mr. W. W., Elgin, Ill.

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Cowing, Dr. Hugh A., Muncie, Ind.
Dinnen, Dr. James M., 225 W. Wayne St., Fort Wayne, Ind.
Dollins, Dr. T. C., Trinity Springs, Ind.
Gage, Mr. L. F., Grandview, Ind.
Goetz, Mr. Henry A., New Albany, Ind.
Hanly, Gov. J. Frank, Indianapolis, Ind.
Hessler, Dr. Robert, Logansport, Ind.
Hurty, Dr. J. N., Secy. State Board of Health, Indianapolis, Ind.
Keene, Dr. T. Victor, Indianapolis, Ind.
McCaskey, Dr. G. W., Fort Wayne, Ind.
McCoy, Dr. George T., 1127 Pearl St., Columbus, Ind.
Potter, Dr. Theodore, 308 Newton Claypool Building, Indianapolis, Ind.
Tucker, Dr. Frederick A., City Sanatorium, Noblesville, Ind.

IOWA

Biering, Dr. Walter L., University of Iowa, Iowa City, Iowa.
Conniff, Dr. Robert E., Sioux City, Iowa.
Kennedy, Dr. Josiah Forrest, Secy. State Board of Health, Des Moines, Iowa.
Kime, Dr. J. W., Fort Dodge, Iowa.
McNeil, Prof. J. H., Iowa State College, Ames, Iowa.
Stevens, Dr. E. Luther, 605 Citizens National Bank Building, Des Moines, Iowa.
Summers, Dr. L. F., Milton, Iowa.

KENTUCKY

Flexner, Dr. J. A., 1044 Second St., Louisville, Ky.
Nones, Mr. W. C., Kentucky Wagon Mfg. Co., Louisville, Ky.
Wilson, Dr. Dunning S., 1700 Brook St., Louisville, Ky.

LOUISIANA

Barrier, Dr. J. M., Delhi, La.

MAINE

Nichols, Dr. Estes, Maine Sanatorium, Augusta, Me.
Webber, Dr. Stephen E., Calais, Me.
Weeks, Dr. Stephen H., Portland, Me.

MARYLAND

Bloodgood, Dr. Joseph C., 904 N. Charles St., Baltimore, Md.
Bosley, Dr. James, Commissioner of Health, Baltimore, Md.
Buckler, Dr. H. Warren, 806 Cathedral St., Baltimore, Md.
Finney, Dr. J. M. F., 1300 Eutaw Place, Baltimore, Md.
Ford, Dr. W. W., Johns Hopkins Medical School, Baltimore, Md.
Fulton, Dr. John S., 1827 N. Charles St., Baltimore, Md.
Futcher, Dr. Thomas B., 3 West Franklin St., Baltimore, Md.
Gichner, Dr. Joseph E., 2102 Madison Ave., Baltimore, Md.
Gilman, Miss Elizabeth, 614 Park Avenue, Baltimore, Md.
Glenn, Mr. John M., 617 Columbia Ave., Baltimore, Md.
Halsted, Dr. W. S., 1201 Eutaw Place, Baltimore, Md.
Hamburger, Dr. Louis P., 1210 Eutaw Place, Baltimore, Md.
Hamman, Dr. Louis, 21 West Franklin St., Baltimore, Md.
Jacobs, Dr. Henry Barton, 11 Mt. Vernon Place, West, Baltimore, Md.
Knox, Dr. J. H. M., 804 Cathedral St., Baltimore, Md.
Linthicum, Dr. G. Milton, 1820 N. Charles St., Baltimore, Md.
MacCallum, Dr. Wm. G., Johns Hopkins Hospital, Baltimore, Md.
Pleasants, Dr. J. Hall, 16 West Chase St., Baltimore, Md.
Pope, Mr. George A., 926 St. Paul St., Baltimore, Md.
Price, Dr. Marshall L., 1827 N. Charles St., Baltimore, Md.
Ruhrah, Dr. John, 839 N. Eutaw St., Baltimore, Md.
Steele, Mr. H. Wirt, Federated Charities Building, Baltimore, Md.
Stokes, Dr. William Royal, 1639 N. Calvert St., Baltimore, Md.
Thayer, Dr. W. S., 406 Cathedral St., Baltimore, Md.
Thomas, Mrs. H. M., 1228 Madison Ave., Baltimore, Md.
Welch, Dr. William H., 807 St. Paul St., Baltimore, Md.
Welsh, Dr. Lilian, The Arundel, Baltimore, Md.
Wilson, Dr. Gordon, 806 Cathedral St., Baltimore, Md.

Buckley, Dr. Samuel S., College Park, Md.
Ellis, Dr. Charles M., Elkton, Md.
Jarrett, Dr. H. S., Towson, Md.

MASSACHUSETTS

Aldrich, Mr. Thomas B., Mt. Vernon Ave., Boston, Mass.
Bowditch, Dr. Vincent Y., 506 Beacon St., Boston, Mass.
Cabot, Dr. Arthur T., 1 Marlborough St., Boston, Mass.
Cabot, Dr. Richard, 190 Marlborough St., Boston, Mass.
Chadbourne, Dr. A. P., 193 Beacon St., Boston, Mass.
Clapp, Dr. H. C., 334 Commonwealth Ave., Boston, Mass.
Clark, Mr. B. Preston, P. O. Box 2682, Boston, Mass.

Clark, Mrs. B. Preston, P. O. Box 2682, Boston, Mass.
Councilman, Dr. W. T., Harvard Medical School, Boston, Mass.
Dunn, Dr. William A., 139 Beacon St., Boston, Mass.
Ernst, Dr. Harold C., Harvard Medical School, Boston, Mass.
Fitz, Dr. Reginald H., 18 Arlington St., Boston, Mass.
Gay, Dr. George W., 665 Boylston St., Boston, Mass.
Goldthwait, Dr. Joel E., 372 Marlborough St., Boston, Mass.
Higginson, Mr. Henry L., 44 State St., Boston, Mass.
Houghton, Dr. Henry L., 56 Bay State Road, Boston, Mass.
Jackson, Dr. Henry, 380 Marlborough St., Boston, Mass.
Joslin, Dr. Elliott P., 81 Bay State Road, Boston, Mass.
Kehew, Mrs. Mary Morton, 317 Beacon St., Boston, Mass.
Knight, Dr. Frederick I., 195 Beacon St., Boston, Mass.
Locke, Dr. Edwin A., 117 Beacon St., Boston, Mass.
Lord, Dr. F. T., 305 Beacon St., Boston, Mass.
McCollom, Dr. John H., 745 Massachusetts Ave., Boston, Mass.
Minot, Dr. James J., 188 Marlborough St., Boston, Mass.
Otis, Dr. Edward O., 381 Beacon St., Boston, Mass.
Page, Dr. Calvin Gates, 128 Marlborough St., Boston, Mass.
Pratt, Dr. Joseph H., 143 Newbury St., Boston, Mass.
Putnam, Dr. Charles P., 63 Marlborough St., Boston, Mass.
Richardson, Dr. Maurice H., 224 Beacon St., Boston, Mass.
Rowe, Dr. George H. M., Boston City Hospital, Boston, Mass.
Shattuck, Dr. F. C., 135 Marlborough St., Boston, Mass.
Shattuck, Dr. George B., 183 Beacon St., Boston, Mass.
Smith, Dr. Theobald, Harvard Medical School, Boston, Mass.
Southard, Mr. Louis C., Room 601, Tremont Building, Boston, Mass.
Stone, Dr. Arthur K., 543 Boylston St., Boston, Mass.
Tileston, Dr. Wilder, 169 Beacon St., Boston, Mass.
Vietor, Dr. Agnes C., Trinity Court, Boston, Mass.
Waite, Mrs. Elizabeth, 707 Tremont Building, Boston, Mass.
Warren, Dr. J. Collins, 58 Beacon St., Boston, Mass.
White, Dr. James C., 259 Marlborough St., Boston, Mass.
Williams, Dr. Francis H., 505 Beacon St., Boston, Mass.
Williams, Dr. Harold, 528 Beacon St., Boston, Mass.
Wilson, Mr. Alexander M., 8 Beacon St., Boston, Mass.
Wolbach, Dr. S. Burt, Boston City Hospital, Boston, Mass.

Brown, Dr. Wilfrid G., Plymouth, Mass.
Butler, Dr. David P., Rutland, Mass.
Carroll, Mr. Charles E., State Sanatorium, Rutland, Mass.
Chadwick, Dr. Henry D., Waltham, Mass.
Coolidge, Dr. Frederick S., 157 South St., Pittsfield, Mass.
Crane, Dr. Bayard T., Mass. State Sanatorium, Rutland, Mass.
Darling, Dr. Eugene A., 138 Brattle St., Cambridge, Mass.
Dunham, Dr. Henry B., Rutland, Mass.
Fisk, Dr. Samuel A., Brimfield, Mass.
Francis, Dr. George E., 79 Elm St., Worcester, Mass.
Gage, Dr. Homer, 72 Pearl St., Worcester, Mass.
Gay, Mrs. Josephine S., Brookline, Mass.
Getchell, Dr. Albert C., 6 Linden St., Worcester, Mass.
Griffin, Dr. Walter A., Sharon, Sanatorium, Sharon, Mass.

HAMMOND, Judge JOHN C., Northampton, Mass.
HANFF, Mr. LOUIS M., Rutland, Mass.
HARRINGTON, Dr. THOMAS F., Lowell, Mass.
MARCLEY, Dr. WALTER J., Rutland, Mass.
MILLET, Dr. CHARLES S., 31 Green St., Brockton, Mass.
NICHOLS, Dr. CHARLES L., 38 Cedar St., Worcester, Mass.
PERCY, Dr. FREDERICK B., 194 Aspenwall Ave., Brookline, Mass.
PHIPPEN, Dr. HARDY, 84 Washington St., Salem, Mass.
PRESCOTT, Mrs. OLIVER, New Bedford, Mass.
RAND, Dr. JOHN P., 820 Main St., Worcester, Mass.
SABINE, Dr. GEORGE K., Brookline, Mass.
SIMMONS, Dr. MOYSES ROGERS, 42 Brook St., Wollaston, Mass.
THRASHER, Miss MARY E., State Sanatorium, Rutland, Mass.
WOOD, Dr. ALBERT, Med. Director State Mutual Ins. Co., Worcester, Mass.

MICHIGAN

ADAMS, Prof. HENRY C., Ann Arbor, Mich.
ALVORD, Dr. AUSTIN W., Battle Creek, Mich.
BAKER, Dr. HENRY B., Lansing, Mich.
BARBOUR, Mr. LEVI L., Detroit, Mich.
BELL, Dr. WILLIAM, Belding, Mich.
CAREY, Mr. HENRY W., East Lake, Mich.
CRANE, Dr. A. W., Kalamazoo, Mich.
DENISON, Prof. CHARLES S., University of Michigan, Ann Arbor, Mich.
DOCK, Dr. GEORGE, Ann Arbor, Mich.
FERRY, Mr. D. M., Detroit, Mich.
GOMBERG, Prof. M., University of Michigan, Ann Arbor, Mich.
HOUGHTON, Dr. E. MARK, 130 Longfellow Ave., Detroit, Mich.
JOHNSTON, Dr. COLLINS H., Grand Rapids, Mich.
KELLOGG, Dr. J. H., Battle Creek, Mich.
KELSEY, Prof. FRANCIS W., 826 Tappan St., Ann Arbor, Mich.
KIEFER, Dr. HERMANN, 89 Forest Ave., E., Detroit, Mich.
KNAPPEN, Mr. LOYAL E., Grand Rapids, Mich.
KOON, Dr. THOMAS M., Grand Rapids, Mich.
MCMILLAN, Mr. WM. C., Detroit, Mich.
MUNSON, Dr. JAMES D., Northern Michigan Insane Asylum, Traverse City, Mich.
PATTERSON, Prof. GEORGE W., Ann Arbor, Mich.
ROBINSON, Dr. D. E., Jackson, Mich.
SHURLY, Dr. E. L., 32 Adams Ave., W., Detroit, Mich.
VAUGHAN, Dr. VICTOR C., Ann Arbor, Mich.
WARTHIN, Dr. ALDRED SCOTT, Ann Arbor, Mich.
WHITE, Mr. PETER, Marquette, Mich.
ZIWET, Prof. ALEXANDER, University of Michigan, Ann Arbor, Mich.

MINNESOTA

BEARD, Prof. RICHARD OLDING, University of Minnesota, Minneapolis, Minn.
BRACKEN, Dr. H. M., Sec'y State Board of Health, St. Paul, Minn.
CHRISTIAN, Mrs. GEORGE H., 404 South 8th St., Minneapolis, Minn.

Corbett, Dr. J. Frank, Minneapolis, Minn.
Dunwoody, Mr. William H., Minneapolis, Minn.
Greene, Dr. Charles Lyman, 150 Lowry Arcade, St. Paul, Minn.
Hall, Dr. P. M., Minneapolis, Minn.
Harrison, Dr. R. H., 485 Collins St., St. Paul, Minn.
Hunt, Dr. F. N., Blue Earth, Minn.
Roberts, Dr. George F., Pillsbury Building, Minneapolis, Minn.
Roberts, Dr. Thomas S., 1603 Fourth Ave., So., Minneapolis, Minn.
Shaw, Dr. A. W., Buhl, Minn.
Stuhr, Dr. Henry C., Argyle, Minn.
Taylor, Dr. H. Longstreet, 75 Lowry Arcade, St. Paul, Minn.
Wesbrook, Prof. F. F., University of Minnesota, Minneapolis, Minn.

MISSOURI

Porter, Dr. William, 3886 Washington Boulevard, St. Louis, Mo.

NEW HAMPSHIRE

Fontaine, Dr. Henri T., Pembroke Sanatorium, Concord, N. H.
Hills, Dr. Frederick L., New Hampshire State Hospital, Concord, N. H.

NEW JERSEY

Bulkley, Mrs. Edwin M., Walnut St., Englewood, N. J.
Cox, Mr. Mark T., 110 Harrison St., East Orange, N. J.
Dinklage, Mr. A., 68 Greenwood Ave., East Orange, N. J.
Francis, Dr. Richard P., 12 Plymouth St., Montclair, N. J.
Halsey, Dr. L. M., Williamstown, N. J.
Hance, Dr. Irwin H., Lakewood, N. J.
Harvey, Dr. Thomas W., 463 Main St., Orange, N. J.
Hemsley, Mr. Frederick, Brighton, Atlantic City, N. J.
Hoffman, Mr. Frederick L., Prudential Insurance Co., Newark, N. J.
Kipp, Dr. Charles J., 560 Broad St., Newark, N. J.
Mellon, Mr. Charles H., Madison Ave., Morristown, N. J.
Merck, Mr. George, Llewellyn Park, West Orange, N. J.
Mutual Benefit Life Insurance Co., Dr. Edgar Holden, President Medical Board, Newark, N. J.
Newton, Dr. Richard Cole, 42 Church St., Montclair, N. J.
Pyne, Mr. M. Taylor, Princeton, N. J.
Reynolds, Dr. Walter, 27 South Indiana Ave., Atlantic City, N. J.
Robinson, Dr. Frank N., 518 Linden St., Camden, N. J.
Schauffler, Dr. Wm. G., 400 Madison Ave., Lakewood, N. J.

NEW MEXICO

Brooks, Dr. Stephen Driver, Fort Stanton, New Mexico.
Bullock, Dr. E. S., Silver City, New Mexico.
Bushnell, Major George E., U. S. General Hospital, Fort Bayard, New Mexicc
Carrington, Major P. M., Fort Stanton, New Mexico.
Hutton, Lt. Paul C., Medical Department, Fort Bayard, New Mexico.

NEW YORK

Abbe, Dr. Robert, 13 West 50th St., New York City.
Abbott, Rev. Lyman, 123 East 78th St., New York City.
Adler, Dr. I., 22 East 62nd St., New York City.
Alexander, Mrs. Simon, 346 West 71st St., New York City.
Arnstein, Mr. Leo, 416 East 106th St., New York City.
Arnstein, Mrs. Leo, 49 East 82d St., New York City.
Aspinwall, Mr. J. Lawrence, 320 Fifth Avenue, New York City.
Avery, Mrs. S. P., 4 East 38th St., New York City.
Babbott, Mr. Frank L., 346 Broadway, New York City.
Bacon, Dr. Gorham, 47 West 54th St., New York City.
Bailey, Dr. Pearce, 52 West 53rd St., New York City.
Baird, Dr. Addison W., 239 West 70th St., New York City.
Baker, Dr. S. Josephine, 8 West 91st St., New York City.
Bangs, Dr. L. Bolton, 32 East 51st St., New York City.
Barrows, Dr. Charles Clifford, 8 West 36th St., New York City.
Batten, Rev. Loring W., 232 East 11th St., New York City.
Behr, Mr. Herman, 75 Beekman St., New York City.
Benedict, Dr. Charles S., 310 West 102nd St., New York City.
Biggs, Dr. Hermann M., 113 West 57th St., New York City.
Biggs, Mrs. Hermann M., 113 West 57th St., New York City.
Billings, Dr. J. S., Jr., 32 East 53rd St., New York City.
Bispham, Mr. William, 12 West 18th St., New York City.
Bliss, Mrs. Wm. H., 6 East 65th St., New York City.
Brandt, Miss Lilian, 105 East 22nd St., New York City.
Brannan, Dr. John W., 11 West 12th St., New York City.
Brett, Mr. George P., 64 Fifth Avenue, New York City.
Brewster, Mr. George S., 49 Wall St., New York City.
Brill, Dr. N. E., 48 West 76th St., New York City.
Bronson, Dr. E. B., 10 West 49th St., New York City.
Brown, Mr. Alfred L., 76 William St., New York City.
Brown, Dr. F. Tilden, 14 East 58th St., New York City.
Bryant, Dr. Joseph D., 32 West 48th St., New York City.
Bull, Dr. William T., 35 West 35th St., New York City.
Bunnell, Mr. J. S., Wells Fargo Co., 51 Broadway, New York City.
Camac, Dr. C. N. B., 108 East 65th St., New York City.
Canfield, Mr. George F., 49 Wall St., New York City.
Carlebach, Mr. Emil, 21 Broad St., New York City.
Carman, Dr. A. R., 27 West 127th St., New York City.
Carnegie, Mr. Andrew, 2 East 91st St., New York City.
Cauldwell, Dr. Charles M., 16 West 54th St., New York City.
Cherry, Dr. William S., 107 West 70th St., New York City.
Clinton, Dr. Charles A., Med. Inspector Department of Health, 112 West 131st St., New York City.
Clyde, Mr. William P., 19 State St., New York City.
Coffman, Mr. Herbert B., 500 Park Avenue, New York City.
Coleman, Dr. Warren, 58 West 55th St., New York City.
Collins, Dr. Charles Farnham, 50 West 55th St., New York City.
Conklin, Mr. Roland R., 111 Broadway, New York City.
Cutting, Mr. B. Bayard, 32 Nassau St., New York City.
Cutting, Mr. W. Bayard, 32 Nassau St., New York City.

Darlington, Dr. Thomas, 969 Sixth Avenue, New York City.
Davison, Mr. E. Moro, 23 Nassau St., New York City.
De Forest, Mr. Johnston, 30 Broad St., New York City.
De Forest, Mr. Robert W., 30 Broad St., New York City.
Delano, Mr. Warren, Jr., 1 Broadway, New York City.
Devine, Mr. Edward T., 105 East 22nd St., New York City.
Dodge, Miss Grace H., 262 Madison Ave., New York City.
Doty, Dr. A. H., Staten Island, N. Y.
Douglas, Mr. James, 99 John St., New York City.
Dow, Mrs. Frederic G., 13 Central Park, W., New York City.
Dows, Mrs. David, 1 East 69th St., New York City.
Dunham, Dr. Edward K., 338 East 26th St., New York City.
Emerson, Dr. Haven, 106 East 62nd St., New York City.
Finley, President John H., 17 Lexington Ave., New York City.
Fischer, Mr. George, 156 West 78th St., New York City.
Fischer, Dr. Louis, 65 East 90th St., New York City.
Fisk, Mr. Harvey Edward, 62 Cedar St., New York City.
Fitzgerald, Dr. Charles F., 141 East 45th St., New York City.
Folks, Mr. Homer, 105 East 22nd St., New York City.
Forbes, Miss Mary, 105 East 22nd St., New York City.
Forney, Mr. M. N., 501 Fifth Ave., New York City.
Freeman, Dr. Rowland G., 205 West 57th St., New York City.
Freudenthal, Dr. W., 1003 Madison Ave., New York City.
Frissell, Mr. A. S., 530 Fifth Ave., New York City.
Frissell, Dr. Lewis F., 113 East 56th St., New York City.
Funk, Mr. I. K., 195 Washington Park, Brooklyn, N. Y.
Gibney, Dr. V. P., 16 Park Ave., New York City.
Gillette, Dr. Curtenius, 4 East 41st St., New York City.
Gleitsman, Dr. Joseph W., 46 East 25th St., New York City.
Godkin, Mr. Lawrence, 30 Pine St., New York City.
Gordon, Mr. George E., 787 Fifth Ave., New York City.
Gottsberger, Mr. Francis, 156 Broadway, New York City.
Guggenheim, Mr. William, 500 Fifth Ave., New York City.
Harriman, Mrs. Borden, 35 East 49th St., New York City.
Harriman, Mr. E. H., 120 Broadway, New York City.
Hartwell, Dr. John A., 50 East 53rd St., New York City.
Hastings, Dr. Thomas Wood, 43 East 58th St., New York City.
Hentz, Mr. Henry, 22 William St., New York City.
Hibbs, Dr. Russell A., 515 Madison Ave., New York City.
Higginson, Mr. James J., 16 East 41st St., New York City.
Hine, Mr. Francis L., 2 Wall St., New York City.
Hitchcock, Dr. E. H., 15 East 11th St., New York City.
Hoffman, Mrs. E. A., 135 East 21st St., New York City.
Hoppin, Mr. William Warner, 52 William St., New York City.
Hoving, Dr. Johannes, 262 Lenox Ave., New York City.
Huber, Dr. John B., 44 East 64th St., New York City.
Huddleston, Dr. John H., 126 West 85th St., New York City.
Huggins, Mrs. G. L., 135 West 47th St., New York City.
Hunter, Mr. Robert, 88 Grove St., New York City.
Huntington, Rev. W. R., 804 Broadway, New York City.
Hutton, Prof. Frederick Remsen, 319 West 107th St., New York City.
Huyler, Mr. John S., 64 Irving Place, New York City.

Jacobi, Dr. A., 19 East 47th St., New York City.
James, Dr. Walter B., 17 West 54th St., New York City.
Janeway, Dr. Edward G., 36 West 40th St., New York City.
Kane, Mrs. John Innes, 49 West 23rd St., New York City.
Kennaday, Mr. Paul, 105 East 22nd St., New York City.
Keppler, Mr. Rudolph, 25 Broad St., New York City.
Kidder, Mr. C. G., 27 William St., New York City.
King, Mr. William F., 410 Broadway, New York City.
Kinnicutt, Dr. Francis P., 39 East 35th St., New York City.
Klein, Dr. William T., Riverside Sanatorium, North Brother Island, New York City.
Knight, Dr. Augustus S., 1 Madison Ave,. New York City.
Knopf, Dr. S. A., 16 West 95th St., New York City.
Koester, Dr. Henry F., 1159 Park Ave., New York City.
Kohns, Mr. Lee, 127 West 79th St., New York City.
Kohns, Mrs. Lee, 127 West 79th St., New York City.
Koniger, Mr. Edward H., Equitable Life Assurance Society, 120 Broadway, New York City.
Lambert, Dr. Alexander, 125 East 36th St., New York City.
Lawrence, Mr. Cyrus J., 15 Wall St., New York City.
Le Fevre, Dr. Egbert, 52 West 56th St., New York City.
Lewis, Mrs. George Richards, 20 Fifth Avenue, New York City.
Lewisohn, Mr. Adolph, 42 Broadway, New York City.
Lilienthal, Dr. Howard, 766 Madison Ave., New York City.
Little, Dr. Frank, 114 Montague St., Brooklyn, N. Y.
Lockwood, Mr. Benoni, 105 East 18th St., New York City.
Loeb, Mr. James, 52 William St., New York City.
Loomis, Dr. Henry P., 58 East 34th St., New York City.
Low, Mr. Seth, 30 East 64th St., New York City.
Lyman, Mr. Frank, 82 Wall St., New York City.
Macdonald, Dr. A. E., 431 Riverside Drive, New York City.
Mack, Mr. Jacob, 92 Liberty St., New York City.
Macy, Mr. V. Everit, 68 Broad St., New York City.
Mannheimer, Dr. George, 1001 Madison Ave., New York City.
Martin, Mrs. John, Grymes Hill, Staten Island, New York City.
Mendelson, Dr. Walter, 159 West 74th St., New York City.
Merrill, Mr. Charles E., 44 East 23rd St., New York City.
Meyer, Dr. Alfred, 801 Madison Ave., New York City.
Mickle, Dr. J. B., Metropolitan Hospital, Blackwell's Island, New York City.
Miller, Dr. James Alexander, 550 Park Ave., New York City.
Milliken, Mr. E. F., 11 Broadway, New York City.
Mills, Dr. Walter Sands, 324 West 89th St., New York City.
Moffat, Mr. George Barclay, 6 East 70th St., New York City.
Moffat, Mr. R. Burnham, 12 East 66th St., New York City.
Morgan, Mrs. John B., 40 East 38th St., New York City.
Morgan, Mr. J. P., 23 Wall St., New York City.
Munn, Dr. John P., 18 West 58th St., New York City.
Munn, Mr. O. D., 361 Broadway, New York City.
Newcomb, Dr. James E., 118 West 69th St., New York City.
Newcomb, Mrs. James E., 118 West 69th St., New York City.
Norris, Dr. Charles, 44 West 44th St., New York City.
Northrup, Dr. W. P., 57 East 79th St., New York City.

Nourse, Mr. C. J., Jr., 245 Lexington Ave., New York City.
Oppenheimer, Dr. Henry S., 741 Madison Ave., New York City.
Ordway, Mr. E. W., 1093 Dean St., Brooklyn, N. Y.
Ovington, Miss Mary W., Hotel St. George, Brooklyn, N. Y.
Park, Dr. William H., 315 West 76th St., New York City.
Parker, Dr. Willard, 8 West 9th St., New York City.
Parsons, Mr. John E., 30 East 36th St., New York City.
Patterson, Dr. Henry Stuart, 51 West 58th St., New York City.
Paulding, Mr. J. K., 112 East 27th St., New York City.
Peabody, Dr. George L., 57 West 38th St., New York City.
Phipps, Mr. Henry, 6 East 87th St., New York City.
Price, Mrs. Miriam Sutro, 379 West End Avenue, New York City.
Prudden, Dr. T. Mitchell, College of Physicians and Surgeons, 435 West 59th St., New York City.
Pulley, Dr. W. J., 945 Madison Ave., New York City.
Putnam, Dr. Charles R. L., 121 East 38th St., New York City.
Randolph, Miss May F., 151 West 140th St., New York City.
Raven, Mr. A. A., 51 Wall St., New York City.
Reinheimer, Mrs. Esther B., 50 East 75th St., New York City.
Richardson, Dr. E. J., 264 West 139th St., New York City.
Riggs, Dr. Austen Fox, 48 East 30th St., New York City.
Rockefeller, Mr. John D., 26 Broadway, New York City.
Rogers, Dr. Charles T. Graham, 128 East 96th St., New York City.
Rogers, Dr. Oscar H., N. Y. Life Insurance Co., 346 Broadway, New York City.
Sayre, Dr. Reginald H., East 45th St., New York City.
Schieren, Mr. Charles A., Schieren Building, Ferry St., New York City.
Schiff, Mr. Jacob H., 52 William St., New York City.
Schilt, Mrs. L., 331 West 101st St., New York City.
Schwyzer, Dr. Fritz, 54 East 58th St., New York City.
Seaman, Major Louis L., 247 Fifth Avenue, New York City.
Seligman, Mr. Isaac N., 21 Broad St. New York City.
Shaffer, Dr. Newton M., 28 East 38th St., New York City.
Shepard, Mr. Edward M., 44 Pierrepont St., Brooklyn, N. Y.
Simpson, Dr. William Payne, 76 West 47th St., New York City.
Smith, Dr. A. Alexander, 18 West 48th St., New York City.
Smith, Dr. Andrew H., 18 East 46th St., New York City.
Smith, Rev. C. B., 101 East 69th St., New York City.
Smith, Mr. G. Stuart, 18 Broadway, New York City.
Smith, Mr. J. Henry, 10 Wall St., New York City.
Smith, Mr. William Alexander, 412 Madison Ave., New York City.
Speyer, Mr. James, 24 Pine St., New York City.
Stella, Dr. Antonio, 214 East 16th St., New York City.
Stewart, Dr. George D., 143 East 37th St., New York City.
Stewart, Mr. William R., 31 Nassau St., New York City.
Stokes, Mr. James Brett, 27 West 43rd St., New York City.
Stokes, Mr. J. G. Phelps, 47 Norfolk St., New York City.
Strauss, Mr. Albert, P. O. Box 1366, New York City.
Strauss, Mr. Frederick, P. O. Box 1366, New York City.
Stubbert, Dr. J. Edward, N. Y. Post-Graduate Medical School, New York City.
Studdiford, Dr. William E., 122 East 34th St., New York City.
Thompson, Dr. W. Gilman, 34 East 31st St., New York City.
Tod, Mr. William Stewart, 45 Wall St., New York City.

Topliff, Mr. Cyrus L., 361 Broadway, New York City.
Townsend, Mr. Howard, 32 Liberty St., New York City.
Villard, Mr. Oswald Garrison, 208 Broadway, New York City.
Wallace, Dr. Charlton, 126 East 34th St., New York City.
Warburg, Mr. Felix M., 52 William St., New York City.
Waters, Dr. Bertram H., 22 East 46th St., New York City.
Watson, Mr. C. W., 500 Madison Ave., New York City.
Watson, Dr. S. P., Riverside Hospital, North Brother Island, New York City.
Weber, Dr. Leonard, 25 West 46th St., New York City.
Wheelock, Dr. George G., 75 Park Ave., New York City.
Whitman, Mr. Alfred A., 13 William St., New York City.
Willard, Dr. Thomas H., Metropolitan Life Insurance Co., 1 Madison Ave., New York City.
Williams, Dr. Linsly R., 839 Madison Ave., New York City.

Allen, Dr. A. H., Saranac Lake, N. Y.
Baker, Dr. Eugene, 108 W. Seneca St., Ithaca, N. Y.
Baldwin, Dr. Edward R., Saranac Lake, N. Y.
Beach, Dr. George William, 115 Front St., Binghamton, N. Y.
Biggs, Mr. Chauncey P., Ithaca, N. Y.
Biggs, Mr. W. P., Trumansburg, N. Y.
Brown, Dr. Lawrason, Saranac Lake, N. Y.
Burnham, Dr. Melvin P., N. Y. State Hospital, Ray Brook, N. Y.
Covert, Dr. J. Byington, Geneva, N. Y.
DeLaney, Dr. J. Pope, Geneva, N. Y.
Duryee, Mr. George V., Saranac Lake, N. Y.
Eddy, Dr. Herbert M., Geneva, N. Y.
Elsner, Dr. Henry L., Fayette Park, Syracuse, N. Y.
Enz, Mr. Frank J., Ithaca, N. Y.
Feustmann, Mr. Maurice M., Saranac Lake, N. Y.
Fish, Dr. P. A., N. Y. State Veterinary College, Ithaca, N. Y.
Gage, Prof. Simon Henry, Cornell University, Ithaca, N. Y.
Goler, Dr. G. W., 127 East Avenue, Rochester, N. Y.
Goodall, Dr. Henry S., Stony Wold Sanatorium, Lake Kushaqua, N. Y.
Gwynne, Mr. John A., Rye, N. Y.
Hammer, Dr. William J., Liberty, N. Y.
Hart, Dr. James A., Slosson Homestead, Geneva, N. Y.
Junger, Dr. Marcus, Montefiore Home, Bedford Station, N. Y.
Kelly, Dr. William Henry, Department of Agriculture, Albany, N. Y.
Kieran, Sister Mary P. H., Gabriel's, N. Y.
King, Dr. Herbert Maxon, Liberty, N. Y.
Kinghorn, Dr. Hugh M., Saranac Lake, N. Y.
Lauderdale, Mr. Walter E., Geneseo, N. Y.
Lupton, Dr. E. J. S., Adirondack Cottage Sanatorium, Saranac Lake, N. Y.
Lytle, Dr. Claude C., Geneva, N. Y.
Macdonald, Dr. W. G., 27 Eagle St., Albany, N. Y.
Moore, Dr. Veranus A., Ithaca, N. Y.
Neagle, Dr. H. B., Liberty, N. Y.
Prescott, Miss Mary R., Saranac Lake, N. Y.
Pryor, Dr. John H., Saranac Lake, N. Y.
Ransom, Dr. J. B., Dannemora, N. Y.
Riddle, Mr. Daniel W., Saranac Lake, N. Y.

Rochester, Dr. DeLancy, 469 Franklin St., Buffalo, N. Y.
Rosenberg, Dr. Leopold, Montefiore Home Sanatorium, Bedford Station, N. Y.
Rubinstein, Dr. J. L., Montefiore Home, Bedford Station, N. Y.
Sand, Dr. Max E., Ardsley-on-Hudson, N. Y.
Scopes, Mr. William H., Saranac Lake, N. Y.
Stebbins, Dr. F. Lansing, Geneva, N. Y.
Stockton, Dr. Charles G., 436 Franklin St., Buffalo, N. Y.
Strong, Dr. R. L., Gabriel's Sanatorium, Gabriel's, N. Y.
Trembley, Dr. Charles C., Saranac Lake, N. Y.
Trudeau, Dr. Edward L., Saranac Lake, N. Y.
Twichell, Dr. David C., Saranac Lake, N. Y.
Van der Veer, Dr. William A., 28 Eagle St., Albany, N. Y.

NORTH CAROLINA

Dunn, Dr. W. L., Asheville, N. C.
Lapham, Dr. Mary E., Highlands, N. C.
Lewis, Dr. Richard H., Raleigh, N. C.
Minor, Dr. Charles L., Asheville, N. C.
Stevens, Dr. Martin L., Asheville, N. C.
Von Ruck, Dr. Karl, Asheville, N. C.
Von Ruck, Dr. Silvio, Asheville, N. C.

OHIO

Baldwin, Miss M. Helen, 519 Wick Ave., Youngstown, Ohio.
Brown, Dr. N. Worth, 216 Michigan St., Toledo, Ohio.
Clark, Dr. Colvin R., 415 Bryson St., Youngstown, Ohio.
Cushing, Dr. Edward F., 967 Prospect St., Cleveland, Ohio.
Dandridge, Dr. N. P., 422 Broadway, Cincinnati, Ohio.
Fischer, Dr. Paul, Columbus, Ohio.
Forchheimer, Dr. F., The Ortez, Cincinnati, Ohio.
Friedrich, Dr. Martin, Cleveland, Ohio.
Hubbard, Dr. Thomas, 205 Ontario St., Toledo, Ohio.
Lowman, Dr. John H., 441 Prospect St., Cleveland, Ohio.
Lyle, Dr. B. F., Municipal Sanatorium, Cincinnati, Ohio,
Norris, Hon. M. A., Youngstown, Ohio.
Peskind, Dr. A., 2447 55th St., Cleveland, Ohio.
Probst, Dr. C. O., Columbus, Ohio.

PENNSYLVANIA

Allen, Dr. Francis Olcott, Jr., 323 South 16th St., Philadelphia, Pa.
Anders, Dr. Howard S., 1836 Wallace St., Philadelphia, Pa.
Anders, Dr. James M., 1605 Walnut St., Philadelphia, Pa.
Angney, Dr. William M., 423 South 15th St., Philadelphia, Pa.
Ashton, Mr. Thomas G., 1814 S. Rittenhouse Sq., Philadelphia, Pa.
Bacon, Dr. Anna L., Hospital for Female Consumptives, Chestnut Hill, Philadelphia, Pa.

Biggs, Dr. Montgomery H., Philadelphia Hospital, 34th and Pine Sts., Philadelphia, Pa.
Boston, Dr. L. Napoleon, 1531 S. Broad St., Philadelphia, Pa.
Brinton, Dr. Ward, 1423 Spruce St., Philadelphia, Pa.
Bromley, Mr. Joseph H., Fourth and Lehigh Aves., Philadelphia, Pa.
Burnham, Mr. George, Jr., 500 N. Broad St., Philadelphia, Pa.
Byall, Mr. J. Bruce, 218 DeKalb Sq., West Philadelphia, Pa.
Clark, Mr. Clarence M., Bullitt Building, Philadelphia, Pa.
Clark, Mr. E. W., Bullitt Building, Philadelphia, Pa.
Clarke, Dr. George G., 1839 N. 17th St., Philadelphia, Pa.
Cohen, Dr. J. Solis, 1824 Chestnut St., Philadelphia, Pa.
Cohen, Dr. Solomon Solis, 1525 Walnut St., Philadelphia, Pa.
Coplin, Prof. W. M. L., Jefferson Medical College, Philadelphia, Pa.
Craig, Dr. Frank A., 732 Pine St., Philadelphia, Pa.
Cummins, Dr. W. Taylor, 1111 Spruce St., Philadelphia, Pa.
Curtin, Dr. Roland G., 22 South 18th St., Philadelphia, Pa.
Daland, Dr. Judson, 317 South 18th St., Philadelphia, Pa.
Edsall, Dr. David L., 1432 Pine St., Philadelphia, Pa.
Ellinger, Dr. T. J., 737 N. 41st St., Philadelphia, Pa.
Ely, Dr. Thomas C., 2031 Green St., Philadelphia, Pa.
Fetterman, Dr. Wilfrid B., Jr., 7042 Germantown Ave., Philadelphia, Pa.
Fetterolf, Dr. George, 330 South 16th St., Philadelphia, Pa.
Flick, Dr. Lawrence F., 732 Pine St., Philadelphia, Pa.
Foltz, Dr. J. Clinton, Summit St., Chestnut Hill, Philadelphia, Pa.
Francine, Dr. Albert Philip, 1404 Spruce St., Philadelphia, Pa.
Freeman, Dr. Walter J., 1822 Spruce St., Philadelphia, Pa.
Gerstley, Mr. Louis, 226 South Front St., Philadelphia, Pa.
Gibbon, Dr. John H., 332 South 15th St., Philadelphia, Pa.
Gildersleeve, Dr. Nathaniel, University of Pennsylvania, Philadelphia, Pa.
Gilliland, Dr. S. H., University of Pennsylvania, Philadelphia, Pa.
Goepp, Dr. R. Max, 1713 Pine St., Philadelphia, Pa.
Goudiss, Dr. Charles H., 5026 Cedar Ave., Philadelphia, Pa.
Hamill, Dr. Samuel McClintock, 1822 Spruce St., Philadelphia, Pa.
Hare, Dr. Hobart A., 1801 Spruce St., Philadelphia, Pa.
Hatfield, Dr. Charles J., 116 South 18th St., Philadelphia, Pa.
Hatfield, Mrs. Charles J., 258 South 18th St., Philadelphia, Pa.
Hewson, Dr. Addinell, 2120 Spruce St., Philadelphia, Pa.
Irwin, Dr. J. Willoughby, 1918 Vine St., Philadelphia, Pa.
Jenks, Mrs. Helen C., 920 Clinton St., Philadelphia, Pa.
Keen, Dr. William W., 1719 Chestnut St., Philadelphia, Pa.
Kelly, Dr. A. C. J., 1911 Pine St., Philadelphia, Pa.
Landis, Dr. H. R. M., 119 South 20th St., Philadelphia, Pa.
Lea, Mr. Henry C., 2000 Walnut St., Philadelphia, Pa.
Le Conte, Dr. Robert G., 1530 Locust St., Philadelphia, Pa.
Lit, Mr. Jacob D., 8th and Market Sts., Philadelphia, Pa.
Longcope, Dr. Warfield T., Pennsylvania Hospital, Philadelphia, Pa.
McCarthy, Dr. D. J., 1342 Pine St., Philadelphia, Pa.
McClary, Dr. Samuel, 308 South 52nd St., Philadelphia, Pa.
Marshal, Dr. C. J., 2004 Pine St., Philadelphia, Pa.
Montgomery, Dr. Clark M., 1325 Pine St., Philadelphia, Pa.
Montgomery, Dr. Edward E., 1703 Walnut St., Philadelphia, Pa.
Musser, Dr. J. H., University of Pennsylvania, Philadelphia, Pa.

Norris, Dr. George William, 1530 Locust St., Philadelphia, Pa.
Pearson, Dr. Leonard, University of Pennsylvania, Philadelphia, Pa.
Prendergast, Dr. M. T., 2435 Columbia Ave., Philadelphia, Pa.
Ravenel, Dr. Mazyck P., 908 Pine St., Philadelphia, Pa.
Renchard, Mr. John A., 1112 Pennsylvania Bldg., 15th and Chestnut Sts., Philadelphia, Pa.
Rhoads, Dr. Samuel, 152 West School Lane, Germantown, Philadelphia, Pa.
Scott, Mrs. Mary Howard, 1830 Rittenhouse Square, Philadelphia, Pa.
Siter, Dr. E. H., 2038 Locust St., Philadelphia, Pa.
Small, Dr. J. Hamilton, 914 South 48th St., Philadelphia, Pa.
Smith, Dr. Karl W., 238 Pine St., Philadelphia, Pa.
Spear, Mr. James, Jr., 1014 Market St., Philadelphia, Pa.
Spear, Mrs. Louise M., The Aldine, Philadelphia, Pa.
Stanton, Dr. W. B., 732 Pine St., Philadelphia, Pa.
Stengel, Dr. Alfred, 1811 Spruce St., Philadelphia, Pa.
Tucker, Dr. Henry, 119 South 20th St., Philadelphia, Pa.
Tyson, Dr. James, 1506 Spruce St., Philadelphia, Pa.
Tyson, Dr. T. Mellor, 1506 Spruce St., Philadelphia, Pa.
Ullom, Dr. Josephus Tucker, 24 Carpenter St., Philadelphia, Pa.
Walsh, Dr. Joseph, 732 Pine St., Philadelphia, Pa.
White, Dr. C. Y., 334 South 16th St., Philadelphia, Pa.
Willcox, Mr. James M., 700 Walnut St., Philadelphia, Pa.
Willson, Dr. Robert N., 350 South 15th St., Philadelphia, Pa.
Wilson, Dr. H. Augustus, 1611 Spruce St., Philadelphia, Pa.
Wilson, Dr. J. C., 1509 Walnut St., Philadelphia, Pa.
Wolf, Mr. Benjamin, 608 Chestnut St., Philadelphia, Pa.
Wood, Dr. George B., 129 South 18th St., Philadelphia, Pa.
Woodward, Dr. George, North American Building, Philadelphia, Pa.

Ashmead, Dr. Albert S., Greentown, Pike Co., Pa.
Baker, Mr. John J., White Haven, Pa.
Blankemeyer, Dr. H. J., White Haven Sanatorium, White Haven, Pa.
Childs, Mr. Otis H., Farmers Bank Building, Pittsburg, Pa.
Craig, Dr. J. J., White Haven Sanatorium, White Haven, Pa.
Dixon, Dr. Samuel G., 1900 Race St., Harrisburg, Pa.
Dudley, Dr. Charles B., Drawer 156, Altoona, Pa.
Ellenberger, Dr. J. W., 922 North 3d St., Harrisburg, Pa.
Gerhard, Dr. George S., Ardmore, Mont. Co., Pa.
Hall, Dr. Henry M., 253 Shady Ave., Pittsburg, Pa.
Hall, Mr. Robert C., 240 Fourth Ave., Pittsburg, Pa.
Heller, Dr. James H., White Haven, Pa.
Hilleary, Dr. Jesse G., Du Bois, Pa.
Houston, Mr. James, 1235 Liberty Avenue, Pittsburg, Pa.
Jenkinson, Mr. J. M., 1155 Liberty Ave., Pittsburg, Pa.
Kemmerer, Mr. M. S., Mauch Chunk, Pa.
Kerr, Mrs. William M., Trainer, Dela. Co., Pa.
Kinyoun, Dr. J. J., Glenolden, Pa.
Kirschner, Dr. Harry E., Oil City, Pa.
Kneeland, Mr. Edward, 2303 Farmers Bank Building, Pittsburg, Pa.
Kunkel, Mr. C. A., Mechanics Bank, Harrisburg, Pa.
McAlister, Dr. J. B., 234 North Third St., Harrisburg, Pa.
McConway, Mr. William, McConway Torley Co., Pittsburg, Pa.

McFeely, Mr. C. A., 2014 Farmers Bank Building, Pittsburg, Pa.
McKnight, Mr. Charles, National Bank of Western Pa., Pittsburg, Pa.
McWilliams, Dr. Frank, Schuylkill Haven, Pa.
Macklin, Mr. C. E., Farmers Bank Building, Pittsburg, Pa.
Martin, Mr. Robert L., 712 Lewis Block, Pittsburg, Pa.
Mellon, Mr. R. B., 514 Smithfield St., Pittsburg, Pa.
Middleton, Dr. William J., 155 North Front St., Steelton, Pa.
Miller, Dr. J. S., York, Pa.
Miner, Dr. Charles H., 115 South Franklin St., Wilkesbarre, Pa.
Neale, Dr. Henry M., Upper Lehigh, Pa.
O'Brien, Dr. H. Z., White Haven Sanatorium, White Haven, Pa.
Rothrock, Dr. Joseph T., West Chester, Chester Co., Pa.
Shoemaker, Dr. Albert Moore, White Haven Sanatorium, White Haven, Pa.
Snively, Dr. A. Barr, Blue Ridge Summit, Pa.
Stockdale, Mr. Elwell, White Haven Sanatorium, White Haven, Pa.
Topham, Dr. Mary E., White Haven Sanatorium, White Haven, Pa.
Turnbull, Dr. Thomas, Jr., 835 Western Ave., Alleghany, Pa.
Wainwright, Dr. J. M., 627 Linden St., Scranton, Pa.
Wood, Rev. Charles, Overbrook, Pa.
Woods, Dr. Edward A., Mgr. Equitable Life Insurance Co., Pittsburg, Pa.

PHILIPPINE ISLANDS

Appel, Lt. Col. D. M., Medical Department, Manila, P. I.

RHODE ISLAND

Anderson, Mr. Alexander J., 123 Pelham St., Newport, R. I.
Burdick, Mr. J. Truman, Newport, R. I.
Bushnell, Mrs. George, Peace Dale, R. I.
Chapin, Mr. Charles V., City Hall, Providence, R. I.
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Perkins, Dr. Jay, 106 Waterman St., Providence, R. I.
Peters, Dr. William H., 21 Waterman St., Providence, R. I.
Putnam, Dr. Helen C., 127 Angell St., Providence, R. I.
Stone, Dr. Ellen A., 157 Benefit St., Providence, R. I.
Swarts, Dr. Gardiner T., State House, Providence, R. I.
White, Dr. William R., 7 Greene St., Providence, R. I.

SOUTH CAROLINA

Dawson, Dr. John L., 82 Tradd St., Charleston, S. C.
Hayne, Dr. James Adams, Greenville, S. C.
McGahan, Dr. Charles F., Aiken, S. C.
Wilson, Dr. Robert, Jr., 165 Rutledge Ave., Charleston, S. C.

TENNESSEE

Haase, Dr. Marcus, Secy. State Board of Health, Memphis, Tenn.

TEXAS

Carter, Dr. William S., University of Texas, Galveston, Texas.
Gallagher, Dr. Francis W., El Paso, Texas.
Paschal, Dr. F., San Antonio, Texas.
Smith, Dr. M. M., Box 177, Austin, Texas.

VERMONT

Campbell, Dr. Edward R., Bellows Falls, Vt.
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Chisholm, Dr. A. S. M., Bennington, Vt.
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Hinsdale, Dr. Guy, Hot Springs, Va.
Irving, Dr. Paulus A., Richmond, Va.
Read, Mr. D. W. R., Virginia Sanatorium for Consumptives, Ironville, Va.

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Luce, Dr. Frank H., Davenport, Wash.

WISCONSIN

Evans, Dr. Edward, 121 South 13th St., La Crosse, Wis.
Harlow, Dr. George A., Northwestern Mutual Life Ins. Co., Milwaukee, Wis.
Schmitt, Dr. Gustav, 1206 Walnut St., Milwaukee, Wis.

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